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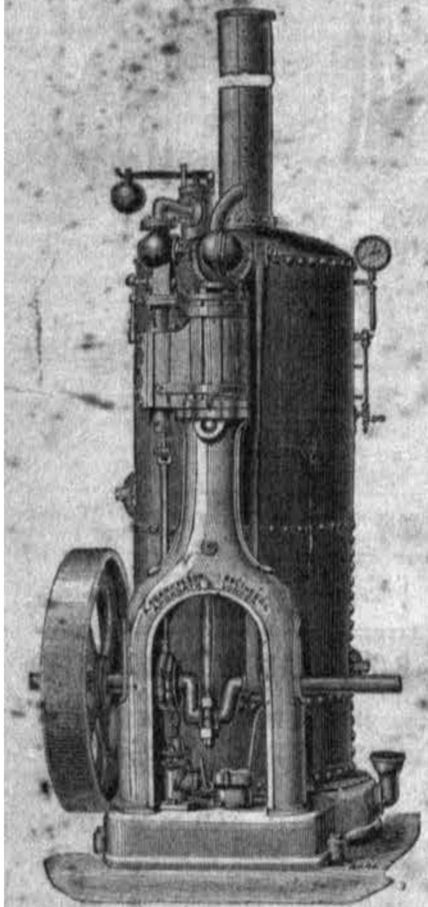

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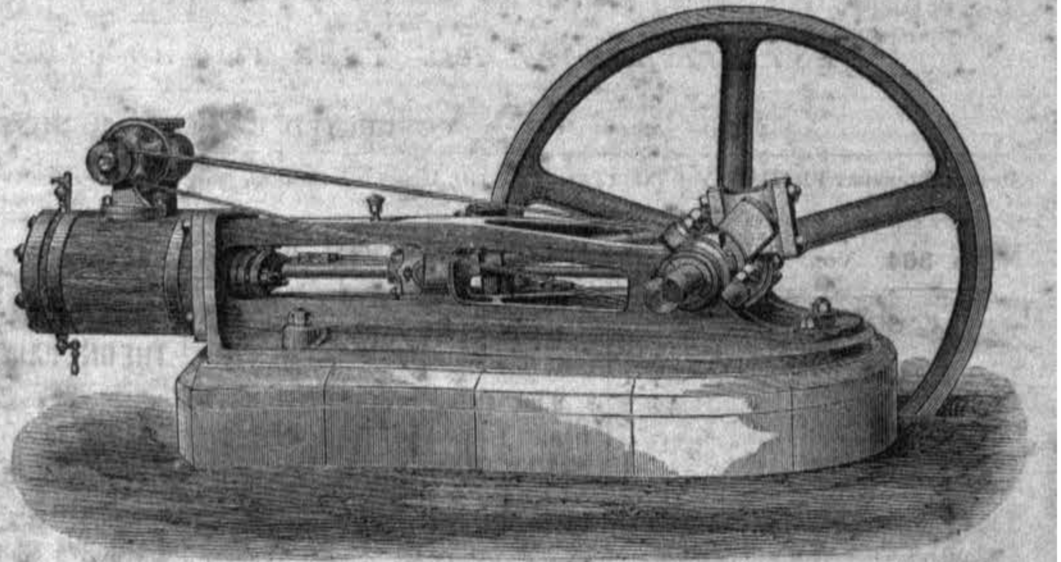

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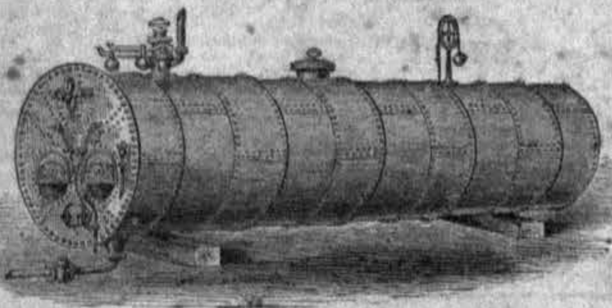

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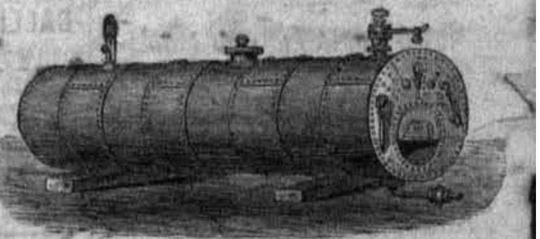

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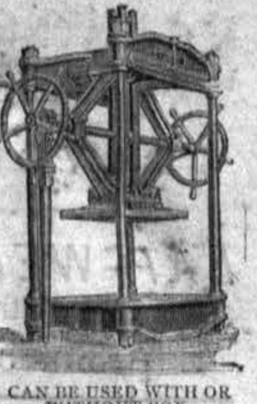

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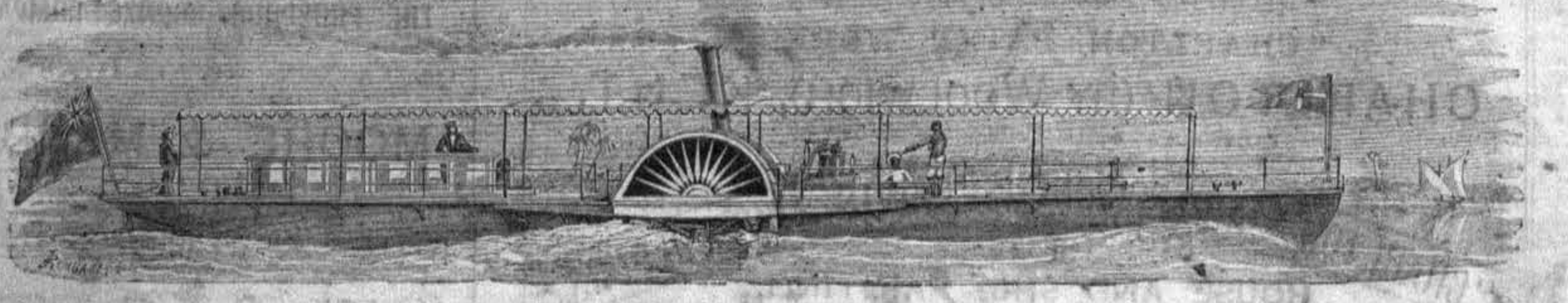

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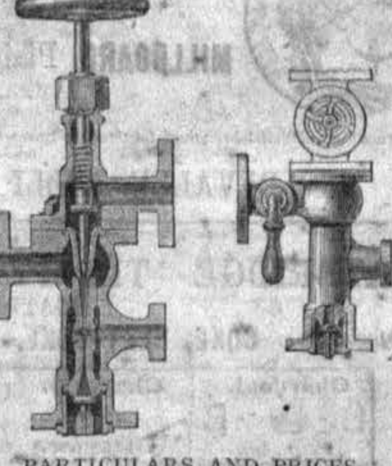

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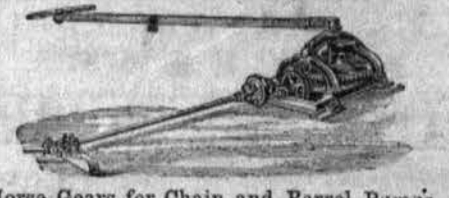

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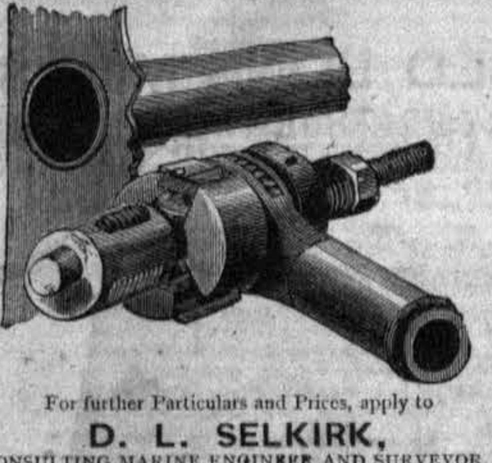

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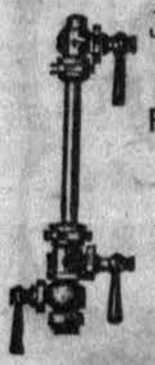

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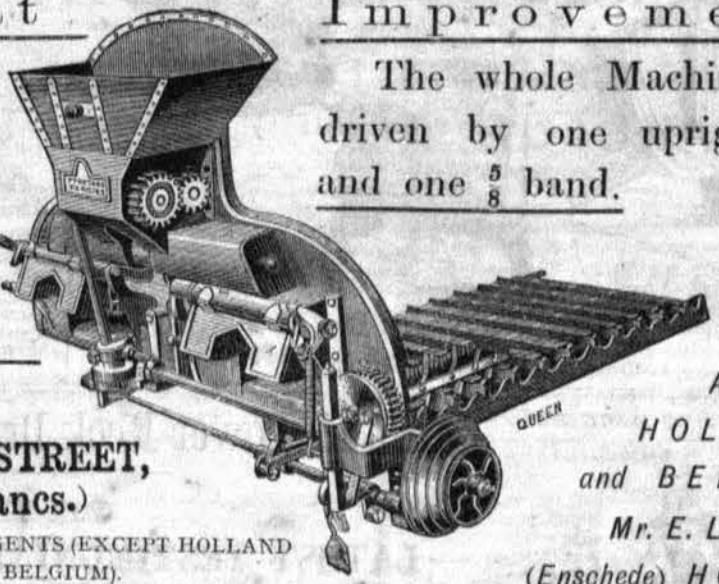

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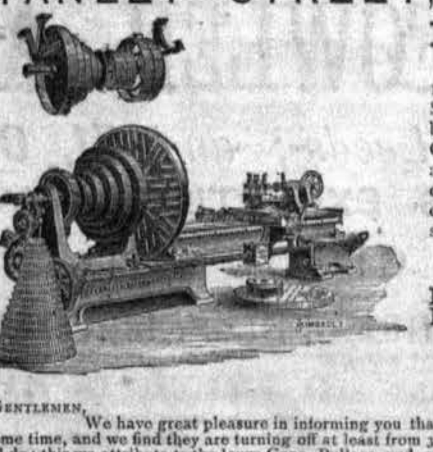

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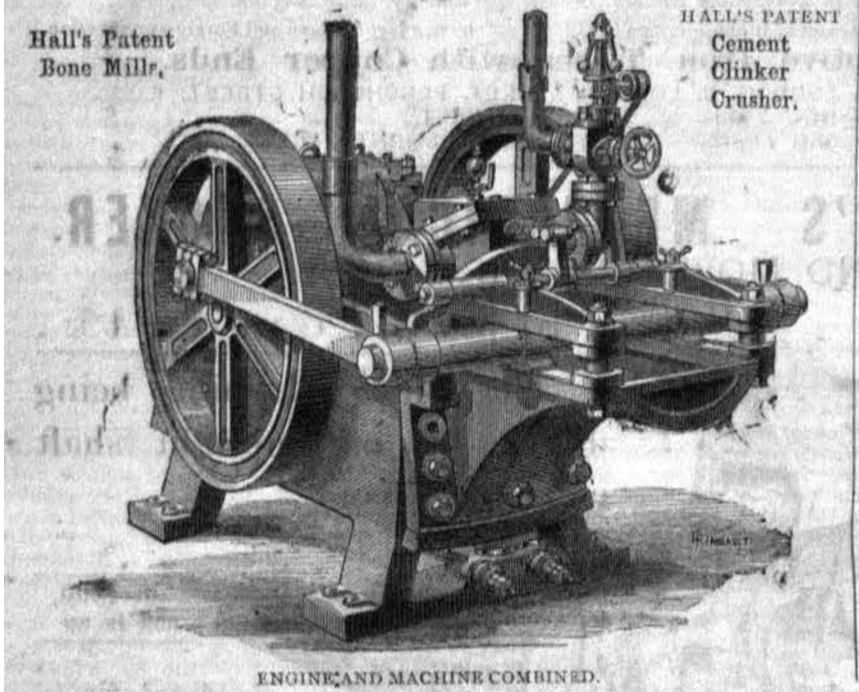

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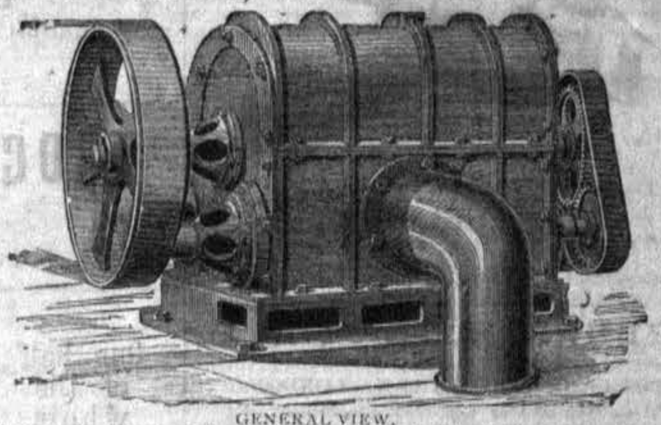

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IRON.

LONDON, FRIDAY, JANUARY 2, 1880.

OUR NEW SERIES.

IT is now nearly sixty years since the establishment of this Journal, under the title of "The Mechanics' Magazine," the first number of which appeared on the 30th of August, 1823. At that time a small octavo weekly number of sixteen pages—a mere pamphlet, in fact—was found sufficiently large to communicate to the public the leading facts of interest in the arts, sciences and manufactures. As time wore on, however, the exigencies of scientific development rendered necessary the enlargement of the journal at three different periods, until, in 1873—after half a century of existence—it assumed the proportions and dimensions with which our readers have been familiar for the past seven years. At the date mentioned, the paper was, virtually reconstructed, the old "Mechanics' Magazine" being absorbed into the new journal under its present title of IRON. But, notwithstanding the many advantages possessed by the paper in its then new form, it has of late appeared to us that there were directions in which changes could be effected which, in our opinion, as we intimated last week, could not fail to prove conducive to the interests of both our readers and our advertisers. This conviction having been fortified and strengthened from without amongst our friends and supporters, has now been acted upon by us, and in this, the first number for the new year, we have carried out the proposed changes. These alterations have involved the commencement of a new series in which it will be seen that there is no departure from the spirit of that by which it has been preceded. On the contrary, the distinctive characteristics of the paper—which are so well known and appreciated, not only at home, but on the Continents of Europe and America, and in the colonies—will be found to be carefully preserved, although the general arrangement and classification of matter has been considerably modified, and, as we think, improved. Our Journal will still be found to be devoted to the science and practice of Engineering, Mining and Metallurgy, particularly that of IRON and STEEL, both at home and abroad. These subjects will also continue to have the fullest attention as regards their commercial aspects, and it will still be our constant endeavour to afford our readers reliable information on this head by means of our special weekly reports, which we shall spare no pains to render accurate, and therefore valuable as a source of reference. Nor will the domain of Scientific Literature be neglected: on the contrary, our readers will continue to be kept well-informed upon all points connected with the progress of art, and of pure, as well as of applied science. In short, no pains will be spared to maintain the widespread reputation which IRON has acquired as an authority upon all questions relating to IRON and STEEL. It is needless to enlarge further upon the features of our new series, as the first number is now before our readers. We would, therefore, only ask them to co-operate with us in maintaining the *status* of IRON by contributing to our correspondence columns information of a practical character upon scientific questions generally, but especially upon those which relate to the manufacture of IRON and STEEL, and their application in the industrial arts.

THE PAST YEAR.

GENERAL RETROSPECT.

THE commencement of a new year has long been regarded by all classes of the community as a standpoint from which the occurrences and transactions of the one by which it has been immediately preceded may be conveniently reviewed. A brief pause in the on-rush of life is made, as it were, by common consent; and of this pause individuals and communities alike avail themselves to take breath, and inquire how much the better, or how little the worse, the close of the old year has found them—to ascertain, in fact, how kind or how ungracious it has been to them. In common with others, we, too, have made it a practice of pausing on the threshold of the new year, in order to take a retrospective glance at the old one. Still pursuing this custom, we propose to see what of good the past year has brought forth, and what of evil. Let us, therefore, pause for a moment, and, as Lord Jeffrey puts it, "call back the departed life for a transitory glow."

Looking back, however, upon the year that has just closed upon us, it is difficult to discover much upon which we may congratulate ourselves. It opened amid gloom and shadow, the legacy bequeathed to it by its predecessor, and which had been accumulating and intensifying ever since the year 1874. It was in that year that, what are popularly known as "bad times" commenced, and the struggle against them was continued down to within a very recent period, and has by no means yet wholly ceased. It has, however, somewhat abated of late, and we sincerely trust that this abatement may not prove of a merely temporary nature. During the past five years every important industry has felt the depression, and prices continue to shrink, dragging down wages with them, obliterating profits, and, in the end, but too frequently resulting in utter loss. Were we to probe this depression to the root we should find one of its great causes to be the gross, and almost universal abuse of the system of credit which obtained some years since. This resulted in difficulties and complications with which we have had to wrestle ever since. The nations of the world were suddenly seized with a desire to take the lead in advancement and numerous civilised—and not a few semi-civilised—countries endeavoured to outvie each other in the development of modern industries and scientific improvements. This show was, to a considerable extent, made with borrowed capital, the result being a condition of simple inflation, the reaction from which has not yet wholly subsided. All this culminated, more or less, with the close of 1878 and found 1879 dawning amid the most depressing influences, the natural consequences of a constantly increasing industrial disorganisation. Nor did this condition of matters greatly improve as the year progressed, for, in addition to commercial anxieties, came fears for our havests—fears which have been but too painfully realised by the deficiency of our crops. Even the very elements appeared to combine to protract the time of recovery from this depression and to lend their aid in landing us in still lower depths; storms and floods becoming the most familiar records of meteorologists. Accidents, too, have spread their frequent gloom over the community; and the year which on its second day witnessed the explosion of the *Thunderer's* gun, with its dire effects, was perhaps not inappropriately closed by the occurrence of one of the most terrible railway disasters on record—that of the Tay bridge, which happened on the evening of Sunday last.

Thus far our retrospect has not been a happy one. Nor can it be, for the greater portion of the year which has just closed upon us has few, if any, pleasant reminisences when regarded from a commercial, or even a social, point of view. Misfortune and loss have appeared in every conceivable shape and form; shipwrecks, railway accidents, colliery explosions, wars and rumours of wars, monetary panics, banking and commercial failures, together with numerous other evils have done their work in rendering the past year memorable in the annals of misfortune and misery. But as the darkest hour precedes the dawn, so, let us hope, that the depth of gloom from which we have recently felt ourselves emerging is now past and gone for ever. There is reason to hope that this may be so, as matters have of late assumed a somewhat healthier aspect, and although we are not justified in anticiptting an immediate return to our former condition of prosperity, we may hope that the worst point has been reached and passed. Although the immediate future of trade and commerce may not be so brilliant as it was before the late unwonted state of depression, it is to be hoped that its prosperity may prove more permanent, which it cannot fail to do if based on sounder principles than those upon which its former evanescent glory was constructed.

But amid all this cheerlessness by which we have been surrounded, science, which never stands still, has progressed. Let us, therefore, turn to the brighter side of the picture, and see what have been her developments during the past year; what fresh victories she has inscribed on her banner. It is true that these have not been very numerous, nor very pronounced, but such as they are they denote practical progress, and indicate the continued subjugation of the forces of nature to the uses of mankind. Perhaps the most interesting and certainly the most prominent scientific feature of the year—apart from those connected with metallurgy and with which we shall deal presently—has been the steady development of electric lighting on a practical scale in London. On the 15th of December last the Thames Embankment had been illuminated by electricity upon the Jablochkoff system for a year. At starting, 20 lights were introduced and were maintained by an engine of 20 horse-power nominal. In course of time 20 more were added, the line of lamps extending from Westminster Bridge to that of Blackfriars. Later on 10 more placed on Waterloo Bridge, the current being still supplied by the same engine. On the date above mentioned 10 more lights were added, the system being extended to the Victoria Station of the Metropolitan District Railway. These lights are being produced and maintained by the same engine which is maintaining the 40 lights on the Embankment and the 10 on the bridge. The engine is now, therefore, maintaining 60 lights—a point of considerable importance. Of not less importance is the distance to which the current is being transmitted. The light-producing centre is at Charing Cross, and the last lamp at Blackfriars is one mile from that centre. The last lamp at the Victoria Station, however, is 1·65 mile from that centre, the range of frontage thus actually covered being 2·65 miles. So far the experiment has succeeded very well, and has led to the solution of many important problems with regard to electric lighting, still exclusive, however, of that all important one of cost.

Of the other systems of electric lighting brought before the public at various times none appear to have made the progress that the Jablochkoff has. The use of the excellent and promising system of M. Rapieff is, we believe, still confined to *The Times* office, where it is doing good service in the machine and compositors' rooms. The Lontin light has been applied lately to the Aldersgate Street station of the Metropolitan Railway and the Siemens' system has been selected, in turn with other systems, for lighting the reading room of the British Museum, which it does admirably. In the early part part of the year the Wallace electric light was placed on trial in the Liverpool Street station of the Great Eastern Railway, but we have not heard of its further application. With regard to the Werdermann, the Wilde, and several other systems which have been introduced to public notice from time to time, we have no information. We are not aware that they have made any progress in London or elsewhere in this country towards solving the question of public lighting by means of electricity. The latest addition to the list of electric lighting systems is that of Mr. Brush, which has just been introduced in this country from America. We have long been waiting for the disclosure of Mr. Edison's discoveries and promised discoveries, which no one on this side of the Atlantic could fail to perceive owed much of their startling character to the peculiar style of American journalism. We make this observation without wishing in the slightest degree to reflect upon Mr. Edison's character as a scientific discoverer. He has done much—very much—towards the development of electric telegraphy and physical science generally, and will doubtless do more. But the fact is, that his enthusiastic friends have so often given him credit for more than he, in his mysterious revelations, has intended to convey, that we hesitate to accept statements unless accompanied by reasonable evidence that they are based upon something a little more substantial than his own indefinite utterances. It would appear, however, that he has at last arrived at a point at which something practical has really resulted. According to recent information, he has devised a system of electric lighting which comprises a generator, a motor, a lamp, and a regulator, the whole forming a complete substitute for gas. The system is to be applied at once to Menlo Park, and to be put in practical operation forthwith in New York City. This done, we shall look for the appearance in England of the "baked cardboard horse-shoe in the little glass globe which furnishes the light." One of Mr. Edison's other inventions—the loud-speaking telephone—has come into practical operation in this country, telephonic communication on a commercial working scale having become an accomplished fact on the 6th of September last, when the Telephone Exchange was opened in Lombard-street, London.

The application of the electric light to purposes of public illumination served to wake the gas companies up a little, and to put them on their mettle. Not that gas-lighting, as a system, was, or even is, in fear of extinction, but gas as an illuminator was so greatly eclipsed by the electric light that it began to be doubted whether it could be made to emit a better light than was afforded by the little yellow spots the public were accustomed to see in our streets. This, it was soon shown, could be done without involving either exceptional conditions or a prohibitory increase of the cost. By means of some well-designed lamps, and his London argand burners, Mr. Sugg succeeded in January last in enabling the Phœnix Gas Company to illuminate a portion of the Waterloo Bridge Road most effectually. In February Mr. Sugg performed the same kind office for the Gas-Light and Coke Company, and thus enabled them to show in Waterloo Place and Regent Street what could be done in the same direction. Later on, namely, in April, the same gas company and Mr. Sugg provided another example of efficient street-lighting by means of gas. This time Queen Victoria Street was selected for the experiment, and the successful results may be still witnessed there. In all these cases there was of course an increased consumption of gas, but in no instance was it anything like prohibitory. While on the subject of gas lighting we may refer to the recent introduction of Sugg and Clark's system of enriched gas used under compression for lighting railway carriages on the Great Northern Railway, where it is under trial and has so far given very satisfactory results. Pintsch's oil-gas, also used under compression for railway lighting, has been introduced on the Metropolitan Railway, besides which it has been applied with success to the lighting of buoys.

In other directions we have to notice the introduction on the South-Western Railway of the ingenious writing telegraph invented by Mr. E. A. Cowper, which enables a person to write a message at a station miles away, the message being reproduced in writing at the end of the wire. The apparatus consists of a transmitting and a recording instrument placed in electrical communication, one being at one station and one at another. Electricity has also been made to subserve another useful purpose by Mr. Henry A. Severn, who has invented a telltale mariners' compass. By means of this instrument the captain or officer in charge is enabled to hear, by the ringing of a bell, when the ship is off her ordered course. Signalling at sea by means of a flashing light thrown on to a body of steam is an invention which has lately been brought under public notice by M. Ramshedt, its inventor, it having been tried by the Trinity Board with complete success so far as the experiment went. In pure science we have the discovery of three or four new metals, whilst Mr. Crookes has been continuing his researches in connection with the ultra-gaseous state of matter, although without any very special results.

In the broad field of engineering several important undertakings have been brought to a successful issue during the year, particularly in the construction of long and lofty railway bridges, and great tunnels. Chief amongst the former is the Severn railway bridge, which is three-quarters of a mile in length, and completes an important link in the railway system of the district. Amongst the latter class of works is the famous Sutro tunnel, whilst the St. Gothard tunnel has progressed rapidly, and now approaches completion. The great work of improvement in the harbour of Genoa has been considerably advanced, while satisfactory progress has been made with the Hell Gate Channel of New York Harbour, and in the proposed tunnel under the Hudson River. The new Harbour works at Douglas, Isle of Man, have been completed, and the pier was opened for public use in August last. In America, several extensive sea piers have been constructed at Long Branch and Coney Island, and the mouth of the Mississippi has seen the practical completion of the opening of its channel to deep-draught shipping.

We have thus gone generally and briefly over the various scientific incidents of the past year. There yet remain other subjects to which we shall specially refer. First amongst these is that of the iron and coal trade of the country, which we shall next notice generally, after which we shall consider it in detail, and with special reference to the various centres of the iron and coal industries. Before doing so, however, and in concluding this section of our annual review, let us not forget the honour done to one to whom the iron and steel industries owe so very much. We refer to Sir Henry Bessemer, upon whom Her Majesty was graciously pleased to confer the honour of knighthood in recognition of the eminent services he has rendered to his country in revolutionising the system of steel manufacture. Sir Henry's name, which must ever be inseparably associated with the development of the steel industry of this country, would add dignity to any title with which it might be adorned.

The Iron and Coal Trades of 1879.

During the year which has just closed upon us all trades alike have suffered from the general depression, and commerce has fallen very low, but the iron trade has been one of the greatest sufferers, if not the greatest of all. Prices of ore, of pig, of rails, of plates, sheets bars, &c., both of iron and steel, have fallen to a depth far lower than was regarded but a few years since as the utmost limit of possible depreciation. At the beginning of this dark year sheets were spread at the corners of streets in Sheffield to receive contributions for the rescue of starving workmen and their families. Hundreds of workmen's houses recently erected between Grimesthorpe, Attercliffe, and the Wicker, still remain in semi-ruin, with broken windows and general dilapidation, which the owners have not the means to repair. The black countries of the Midlands, of Yorkshire, Wales, and Scotland have displayed similar miseries.

The princely fortune of many a great capitalist is now reduced to a modest income, and some have succumbed entirely. These last, however, are far less numerous than might have been expected, and this fact must afford to all thoughtful minds a powerful consolation. The iron trade must undoubtedly have a strong constitution, thus to have survived the ordeal of the last three years. Such a display of intrinsic vitality is a hopeful symptom for the future; it shows that our ironmasters and ironmen are largely endowed with that sublime ignorance which renders it impossible for an Englishman to know when he is beaten. Foreign competitors who have indulged in the wild dream of driving British iron out of the world's markets, have been supplied with information they will not easily forget. The prices at which British iron and steel have been exported during 1879, without annihilating the British iron and steel trade, has shown them what they have to do before they can beat us.

Among the sweet uses of this adversity has been one which is remarkably characteristic of the iron trade of this country, viz., that when trade is slack and prices low, men, who in prosperous and busy times are too much occupied to bother themselves with inventions, have eagerly welcomed the aid of science. Had Messrs. Thomas and Gilchrist brought out their invention five or six years ago, when anything having the colour of iron was eagerly demanded, and no questions asked concerning quality, it is doubtful whether they would have obtained so much attention and encouragement as they have lately received, and without which they could not have achieved their present remarkable success. Nothing could be more opportune than this invention. Our energetic North-countrymen had recently opened up a new iron-making district that was to be fed mainly by its native ores. They had erected the largest and finest blast-furnaces the world has yet seen, and invested vast amounts of capital in them and their appliances and adjuncts. The primary commodity to which they looked for affording a profitable return was rails, and next to these tires, shafting, and other massive iron work for which a hard quality of puddled iron was applicable. While the development of this new industrial region was yet in progress, the Bessemer process was invented, and by the time the Yorkshire development was completed Bessemer rails, Bessemer tires, Bessemer shafting, &c., had gained a footing and established a demand, which, supplemented by the Siemens-Martin products, threatened the Cleveland iron trade with something approaching to annihilation. The enemy at the bottom of all this was phosphorus, which rendered the Cleveland iron unfit for either of the new processes. This phosphorus, though oxidised in the Bessemer converter, and converted into phosphoric acid, and thus for a moment separated from the iron, is as rapidly recombined; for iron, at the temperature of the Bessemer converter or Siemens furnace, seems to be capable of reducing the phosphoric acid back again to phosphorus, and combining with this as well as with its oxygen; thus a vicious circle is repeated, and the poison remains.

It has long been theoretically inferred that if a base or alkali be thrown into the converter it may combine with the phosphoric acid; and Sir Henry Bessemer in 1855 claimed amongst other devices a contrivance for injecting soda, potash, &c., through the blast-pipe into the converter. But these basic fluxes attack the silicious lining, and are rapidly neutralised at its expense. The true practical merit of Messrs. Thomas and Gilchrist is that they have overcome this difficulty, by inventing a lining, basic in itself, and affording the desired basic flux, which, in the form of cinder or slag, combines with and carries away the phosphoric acid as quickly as it is formed by oxidation of the phosphorus. They have not merely written papers on the subject or proposed to do it, but have actually done it successfully; and unless we are all deceived the giant furnaces of Yorkshire will ere long be blowing at their hardest for the production of pig-iron convertible into Bessemer mild steel. The supply of Cleveland ores being practically inexhaustible, and obtained so cheaply, Bessemer rails, &c., are there producible at a price that will drive all competitors to despair. The Middlesborough ironmasters may thank the folly of American legislators for this. Had American ironmasters learned the lesson of free trade early enough, their superior iron ores, or the pigs made from them, would have gained such a footing in this country as raw material for British iron-making, that nobody would have had the requisite inducement to struggle, as Thomas and Gilchrist have, with the costly problem of rendering the Cleveland ores capable of competing successfully with American hematites.

Another invention which, though previously commenced, was brought into practical working during 1879, is Barff's method of coating iron with a preservative film of its own magnetic oxide, by simply exposing the finished work to the action of superheated steam, in a suitable muffle, air and moisture being carefully excluded. If this proves to be as successful as it is said to be, we may look forward to a large extension of the use of ornamental iron work, chiefly artistic castings, for architectural purposes and domestic uses. We may set aside the narrow and shallow view we sometimes hear expressed, that it is good for trade that iron wares should be worn out rapidly. The practical result of this weakness of iron work and utensils is to cause such wares to be superseded by others that are more durable; and the contest between wood, and stone, and iron, for structural purposes, mainly depends upon the durability of the latter, as regards its freedom from liability to rusting.

Hollway's process for the reduction of metallic sulphides by the agency of the oxidation of their own sulphur, is another great invention, the practical development of which will take date in 1879, and help, with the others, to redeem the dismal record of the year. Its influence will be felt in the metallurgy of copper, nickel, cobalt, silver, &c., rather than in that of iron, and in countries where cheap coal is not available, rather than in Britain, seeing that its main feature is the substitution of sulphur for carbon in the smelting of ores that consist mainly or entirely of pyrites. Its influence on the staple trade of Swansea is problematical. It may do it some damage by causing some of the ores now shipped to Swansea for smelting to be smelted where they are found; or, on the other hand, it may have the opposite effect by supplying Swansea with crude regulus reduced on the spot where ores are found too poor to be carried away profitably in their original bulk. From what we have learned concerning the recent development of Mr. Hollway's process the development in this direction appears very promising.

The latter end of 1879, regarded commercially, gives better promise than did its beginning. A revival of foreign trade has decidedly commenced. All dealers in iron and hardwares have kept down their stocks to the lowest possible minimum during the bad times, and are now arranging for their replenishment. They are expecting good orders after the turn of the year, and manufacturers are hopeful accordingly. We must not, however, forget that the chief cause of all the depression is yet in operation. The deficient harvests still impose upon the nation the necessity of buying from abroad a vast quantity of food that otherwise should have been produced at home, and we are poorer by the many millions thus expended. The pinch of this poverty stints every enterprise, and leaves a smaller surplus to be expended in everything less necessary than daily bread. Should 1880 be a year of sunshine all this will be speedily remedied, and the croaking fraternity, both at home and abroad, will learn that the commercial prosperity of Great Britain rests on too solid a foundation to be more than temporarily shaken by any temporary influence.

Barnsley and South Yorkshire.

The year just closed will be long remembered as a memorable one both by coalowners and miners interested in the South Yorkshire coal trade. Throughout none of the coalfields of the United Kingdom have there been greater changes during the past few years than in this district, which are only beginning to be seen in their true light. During the coal famine, capitalists became, as it were, intoxicated with the success of persons engaged in the coal trade, and the result was that fabulous sums were invested, and new coalfields were entered and opened out on such a scale as to astonish even those most intimate with the business. In 1873 Mr. Wardell, Her Majesty's Inspector of Mines for Yorkshire, had notice that 30 collieries had been opened, out from which coal was being raised. In the same year he also received notice that 97 were about to be commenced, which, with 18 more of which he had received notice up to 1874, brought up the number of collieries then in course of sinking to over 100 in two years. Although many of these have either been abandoned or let alone, owing to the low price of coal, there are, however, several large and important undertakings which were commenced at that time at actual work, and as some of these are laid out to produce from 1000 to 1200 tons per day, there can be no doubt but that they are playing an important part in the trade of the district. In several instances the sinkings were put down to the Silkstone seam from the Barnsley bed, thus solving an important question as to the existence of that valuable seam where the thick coal had been exhausted. Some of the concerns are laid out on an elaborate scale, and, being replete with all the modern machinery and appliances of the day, they have completely renovated the output, so far as extent is concerned. Considering the great resources of the district, the trade during the year has been moderate, but prices have been so low that many large concerns have been worked at a loss. The year was ushered in with gloomy prospects, for in the first week notices for a reduction equal to 12½ per cent. were given, and that at a period when most of the pits were not working more than half time. This led to a good deal of contention, resulting in strikes and stoppages. A day or two before the general notice expired, Mr. Mundella, M.P. for Sheffield, stepped in and advised the men to return to work at the old rate of wages, and put the other to arbitration. This was ultimately done, and the arbitrators, being unable to agree, called in Mr. Ellisson, judge of the Sheffield County Court, who awarded that no reduction should take place. The award, however, did not prevent the district coalowners from closing their pits, so that notices for the discharge of large batches of miners were soon after given. This resulted in many disputes, one of which had not been settled at the close of the year. The largest quantity of both Silkstone and Barnsley house-coal is forwarded to London by rail, and during the year the quantity sent has been pretty large considering the high tonnage rates and the competition which the district coalowners have to contend against from seaborne coal. During the year one or two unsuccessful attempts have been made to get the rate reduced. The strike on the part of the employés of the Midland Railway Company seriously interfered with the traffic, and had the effect of enabling coal merchants to make an advance of 2s. per ton; the price being afterwards quoted at 28s. In the month of March prices declined 2s., and during the summer months the highest prices were 24s. per ton, and up to the present time the rate in London has ruled from 22s. to 23s. per ton. The tonnage from the district to London so far as Silkstones were concerned opened very well, for during the first month seven pits supplied 19,300 tons. During the months of February and March business held well up, about 19,000 tons being forwarded each month, whilst in May 25,700 tons were forwarded by the Great Northern from eight Silkstone collieries. The traffic fell off in

June, July and August, when only about 49,500 tons were sent from seven of the largest pits. The tonnage was lowest during the month of September, when only 11,500 tons was sent, but next month something like 18,000 tons were accredited to the same pits. The pits working what is known as the thick seam did a good business during the early part of the year, 27 collieries sending 35,000 tons in March; but during June 12 of the leading collieries only forwarded 13,200 tons as compared with 10,000 during the following month. During the months of October and November the tonnage increased, and as the year closes a pretty large quantity is being sent away. The demand for steam or hard coal has on the whole been pretty active, shipments from Hull and Grimsby for the Baltic ports commenced early in May and were well maintained until the month of November. When, as is usually the case, the weather puts its veto on the trade, prices of this class of fuel either for shipment or locomotive use, have been exceedingly low. Contracts for supplies to several railway companies have been executed as low as 5s. 6d. to 5s. 8d. per ton, whilst house-coal has realised at various periods of the year 5s. 10d. to 6s. 8d. per ton. The business doing in slack and small coal has throughout the year been only moderate, whilst prices have been so low that owners have had to sell at less than the cost of production, leaving the question of royalty and interest upon capital out of the question. During the past three months the coke trade, which in the early part of the year was only limited, has greatly increased owing to the revival of the iron trade in the Frodingham and other districts. The year has been an important one in the history of the South Yorkshire Miners' Association, whose counsels have unfortunately been opposed to the prosperity of the trade. During the year a Conference was held at Barnsley to consider the desirability of setting down the whole of the collieries in the United Kingdom. After two days' discussion, an adjournment took place to Birmingham, where the movement was considered, but fell through. The iron trade throughout the first three-quarters of the year was very much depressed, so much so that most of the works were only employed about half time. The mills and forges up to the last quarter of the year have been but indifferently worked; but since the revival set in matters have somewhat improved. About an average output of pig-iron has been produced at the furnaces in blast; and since the middle of October stocks, which had become pretty large, have been considerably declined on account of the increased demand and advance in the prices of iron. There has, upon the whole, been a very fair demand for Bessemer steel rails, tires, and axles, which have been largely manufactured at the works of Messrs. Cammell and Co., at Penistone, and other places. Most of the local foundries have been slack for orders, having, to a great extent, to depend upon local colliery works for miscellaneous castings; business has been but slow. Engineers and machine-makers have also been but badly employed, and a larger number of operatives connected with the local branches of the Amalgamated Engineers have been on the pay-books than has been experienced for years.

BIRMINGHAM.

The year that has just closed has witnessed a remarkable and a very welcome change in the position and prospects of the staple industries of this district. At the opening of the year these were in a very depressed state, the long-continued absence of activity having led to a largely-diminished production, and the paralysis of foreign trade, combined with a sluggish home demand, having brought down prices to a hopelessly unremunerative level. At the first local quarterly meeting in January, stocks were reported as still being heavy, notwithstanding the abatement made in prices, orders were scarce, and both manufacturers and merchants entertained no hope of any early recovery in trade. The nominal quotations for pig-iron were as follows:—Cold-blast, £4 5s. to £4 10s.; hot-blast, £3 5s. to £3 15s.; and cinder-pig, £2 to £2 10s. per ton. Marked bars were quoted £7 10s., but some good makes were to be had at £7, and marked bars ranged as low as £6 per ton. Three months later these prices were confirmed, the stagnation in trade being continued throughout the quarter. In all departments dulness was the prevailing tone of the local markets. The quarterly pig contracts were less than the average of previous quarters, and although the depression in the finished-iron trade was hardly so marked as in crude iron, business was generally characterised as flat and unprofitable. Any slight improvement which had manifested itself in the export trade was more than counterbalanced by the heavy falling off in home orders and the continued heavy depression on the Australian, Brazilian, and South American markets. In all departments manufacturers reported business as far below the average of the season in extent, while as regards profit on the transactions, the aspect of the situation was still more unsatisfactory. A large proportion of the work on hand was simply for stock, and stocks were reported as being already inconveniently heavy. During the second quarter of the year the aspect of affairs continued very discouraging. The incessant heavy rains not only had the effect of checking the usual building operations of the spring season, but also precluded the hope of anything like an abundant harvest. Retail trade is at a very low ebb, the revenue returns were falling, pauperism was increasing and orders in nearly every department of trade were strictly confined within the narrow limits of immediate necessity. The results were plainly discernible when the midsummer quarter day of the South Staffordshire iron trade arrived. It was reported that out of upwards of 140 blast-furnaces within the district, only twenty-two were in blast, and the meeting was marked by general weakness and depression. Very little business was done, the most liberal offers of concession on the part of manufacturers failing to secure purchases of any magnitude. The normal prices of the previous quarter day was confirmed, but all sorts of unmarked iron were decidedly weaker than three months previous. Manufacturers, merchants, and factors combined in reporting increased quietude in trade. It was generally felt that agricultural prospects on which the immediate future of the home trade very largely depended were in a very critical state, and that unless warm seasonable weather came promptly to the rescue many agriculturists who had for some few years borne up against adverse seasons would be brought to ruin. The consciousness of this danger induced additional caution on the part of traders, and very serious doubts were entertained as to whether the hoped-for recovery in trade during the latter half of the year would be realised. Happily, these fears proved unfounded, for it was not long after the half-year had turned that the influence of the rapid improvemant which had been taking place in the trade of the United States began to make itself felt in our markets. Some heavy orders for rails which had been placed at the low rates then current were the first recognised indications of this movement. Extensive orders for pig-iron and old iron followed, and gradually it was ascertained that these were not isolated transactions of a merely speculative character, but the legitimate outcome of a remarkable expansion in American trade. The maintenance of what has evidently a real consumptive demand created confidence, and afforded a stimulus to the local iron trade, which resulted in strengthening prices, and subsequently in establishing an advance in quotations—a circumstance which, by inducing consumers both at home and in other foreign markets, to place orders which they had hitherto been keeping back, promoted increased activity. Hence an improvement, both as regards raw and finished iron, was definitely established prior to the quarterly meeting in October, prices being strong all round at the recent advance. Nearly all kinds of native pig were from 5s. to 10s. per ton higher than in July—steels had advanced 15s. per ton, and galvanic iron fully £2 per ton; and there was a very considerable rise in the price of tin-plates, for which a brisk demand had been experienced. From October up to the close of the year the revival has widened and deepened. At first only the raw material was much affected, then heavier classes of local manufactures, such as tubes, plates, hoops, sheets, cut-nails and other kindred articles experienced the influences of the reaction, prices widening rapidly in sympathy with the advances in iron. The revival in iron-shipbuilding, both on the Clyde and at Barrow-in-Furness and other ports, contributed to the extension of the improvement of local nut and bolt manufacturers, rivet and chain makers; and the firms who turn out naval brass foundry have been kept fully employed for some time past. Local hardwares generally, with very few exceptions, have, by this time, more or less, felt the beneficial influence of the favourable movement in trade, although it can scarcely be said as yet to have attained six months' duration. There can be no doubt that the comparative paralysis of the home trade, owing to the serious agricultural depression, coupled with the circumstance that some of the best colonial markets have been recently characterised by singular inactivity, have served to check the full development of the progressive movement which had its origin in the American revival; but, at the same time it cannot be denied that the demand for nearly all our local manufactures has been largely increased, that prices have become more remunerative, and that production is gradually extending without any apparent weakening of the market. To form some idea of the advance in values, it will also be necessary to compare the local coal quotations. Native hot-blast pig, £4 5s. per ton; marked bars, £9 per ton; sheets, £10 to £11 per ton; and plates, £10 10s. to £11, with the quotations already given as prevailing at the commencement of the year. Looking at the general aspect of the local iron trade, it is not too much to say that it closes for the year with a buoyancy and a strength which has had no parallel since the period of the Franco-German war, although it must be admitted that the orders at present in the hands of manufacturers are not of any special magnitude, and that amongst the most experienced makers of the trade some doubt is felt as to the stability of the present unquestionably high standard of prices.

CLEVELAND.

The year just elapsed has been one of severe trial for the Cleveland district. In the beginning fell upon it the dread dark hour which, true to the general saying, immediately precedes the dawn, and out of that darkness some of its greatest firms failed to emerge. Messrs. Hopkins, Gilkes and Co., Messrs. Lloyd and Co., Messrs. T. Vaughan and Co., have passed away as ironmakers, and many a rolling mill was quieted for a time or altogether. But the dark has gone, the light has come, and the wheels of our great iron industries are flying faster than ever. Amidst the dark there was one bright gleam lit up the general gloom, when it was announced through *The Times* that the problem of the dephosphorisation of iron was at last solved, and subsequently that it had proved a commercial success. But this, though full of great hope, did not remove the present pressure. Relief came from a rather unexpected quarter and in a rather abnormal way. The American demand saved us and began the impetus which it is hoped will be sustained through the coming year. The average price of No. 3 over the whole year has been 36s. 7d., the lowest being 32s. 6d. and the highest 53s. Four months ago the iron makers were in despair. The most sanguine of them never dreamed of such a rise as 20s. a ton by Christmas with such a prospect as they had then before them. So far as can be estimated at present the make of pig-iron in the district has been about a million and three quarter tons for the year, being about a quarter of a million less than in 1878. The shipments of pig-iron from the port of Middlesborough, which in 1878 were 760,039 tons, have increased in 1879 to about 817,514 tons. This over the year; but during the last four months the exports have been for 1878, 235,000 tons, and for 1879, 326,000 tons. The demand for steel rails has helped the drain upon the pig-iron market in promoting the business of our iron industries. This has rather aided in retarding the development of Cleveland steel, but that has by no means been lost sight of, plant more adapted for this specialty being in course of erection. And now the close of the year is witnessing the reconstruction of many of those companies which failed under the long-continued depression—so quickly and so energetically is the new life re-animating all with its wonderful vitality.

DERBYSHIRE.

The iron trade throughout Derbyshire has during the past year been only moderately active. In some instances the works devoted to the make of gas and water pipes have been kept fairly going with the manufacture of that kind of material. Lead mining has not exhibited much alteration, about an average business having been done throughout the year. During the last three months the make of pig-iron has considerably increased, the Sheepbridge Company and other firms having increased their furnaces. The iron trade generally has improved, and the year closes with much better prospects than when it opened. The position of the Derbyshire coal trade has, taken as a whole, been active. During the first month of the year, the district coalowners, who cater so largely for the metropolitan trade, sent a large tonnage, the Midland alone taking from Clay Cross nearly 15,000 tons, whilst the total which was sent from that place during the month by all lines was close upon 25,000 tons. Some collieries in the Eckington and other districts were accredited with 56,500 tons. As the year progressed the tonnage kept well up, for in the month of March ten collieries, including Clay Cross, Eckington, Grassmoor, Blackwell, Staveley, and Tibshelf, forwarded 63,000 tons. During April and May the traffic kept up very well, whilst some other districts were depressed. For instance, the Midland took nearly 19,000 tons from Clay Cross during May, together with 8,000 tons from Eckington, and about the same quantity from Hucknall and Grassmoor. In August the Midland took 114,100 tons, against 117,300 tons in July, from eleven of the leading Derbyshire pits. No falling off was apparent during the month of September, the Midland again conveying a large tonnage. From Clay Cross no fewer than 12,500 tons were sent, as well as 8000 from Grassmoor and 7000 from Tibshelf. The traffic during the month of October considerably increased, Clay Cross furnishing 7000 tons more coal than was sent in the preceding month. Eckington also forwarded 3500 tons more, and Staveley about the same quantity, in excess of September. Twelve of the leading pits were accredited with 128,000 tons in September, and sent 150,000 during the succeeding month. In November Clay Cross furnished something like 26,000 tons, whilst Eckington sent 16,000, Langley Mill about a similar tonnage. During the year, the tonnage of steam-coal which has left the district has been but of a moderate character; prices of this, as of other kinds of fuel, have been very moderate. A good deal of capital gas-coal has found its way to the Midland counties as well as to other parts. There has been a fair demand for coke towards the close of the year, and in many instances the output has been improved to meet the extra demands made upon makers by the revival in the iron-smelting trade. Collieries, generally speaking, have been worked without much profit, and in some instances to a loss, and masters have been obliged to appeal to their men for assistance by reducing their wages. Early in January notices for a reduction equal to about 12½ per cent. were given at many of the collieries in the district, owing to the depressed state of trade and the low figure at which coal had to be sold in order to compete with other districts. This gave rise to a good deal of contention on the part of the men. After considerable discussion the matter was referred to arbitration, and ended in the umpire (Mr. Ellisson) awarding no reduction. The owners, having found no relief, were compelled to set down part of their pits where the men would not submit to an alteration of prices. The district has been more or less affected by disputes on the wages question; but strikes have not been so general as in the adjoining district. The chief movement connected with mining pursuits affecting the district has been the formation of a Miners' Accident Fund, which it is intended shall embrace the Derbyshire, Nottinghamshire, and Midland Counties, which it is to be hoped will succeed. It may be stated that a similar fund has existed for twelve years at the Staveley Works, and up the end of September last no less a sum than £59,988 had been received, and £57,027 expended, leaving a balance of £2961 in hand. The fund is supplemented by grants from the company of the extent of 25 per cent. of the members' subscriptions, so that since its establishment the firm has subscribed no less a sum than £7000. This and other privileges enjoyed by the workmen employed under the Staveley Company have rendered it noted for its benevolence.

Forest of Dean.

Ironmaking in the Forest dates back to the earliest period of the Roman occupation; but of modern times, possibly no year gave evidence of more intense depression and despondency than the one just closed. 1879 will be alike memorable for its vicissitudes, as for low prices, hopelessness and dismay. Not only had iron-making reached a position of lassitude, declension, and lifelessness unparalleled in degree, but the developments of which so much was written in regard to the inferior ores of Cleveland, appeared to threaten the speedy annihilation of the ironmaking of districts such as this. Experience, the great revealer, has, however, proved the groundlessness of such alarms. The year commenced with Forest pig, No. 3, at 65s.; No. 4. 62s. 6d. In the month of June prices had given way, by successive reductions, to 54s. No. 3; and 51s. 6d. No. 4—a minimum never previously reached. Stocks had accumulated to some few thousand of tons, and at this period, Mr. Crawshay, the late ironmaster, a man of strong nerve, disheartened by the unparalleled condition of this industry, seriously contemplated the temporary abandonment of iron production. Notices month after month were given to the furnace men, their wage-rate had dwindled to a scale previously unknown, the miners of the same firm were shut out four days per week—reducing the aggregate to less than 12s. per week; mines in various parts of the district were closed; two furnaces, out of the Forest ten, only were in blast; and such was the disheartening condition of the metallurgy of the period named. It is true that the production position has not changed; nevertheless, stocks are now cleared either at the last quarter-day values or subsequently enhanced prices, quotations meanwhile have reached the satisfactory standard of 100s. per ton. This revival has favourably influenced mining, and to-day hæmatite ores are fetching 14s. per ton. into trucks, instead of 9s. the prevailing quotation of midsummer. Moreover, iron mines long silent and desolate have been reopened, giving employment to the suffering ore-cutter, and what were industrial wildernesses are once again, one by one, gradually, but surely becoming resonant with the music of the miners' pick, and bright under their altered circumstances. In regard to an immediate increased production of crude iron in the Forest, there is little probability. This, however, results rather from miscalculation than any degenerated position of the Forest by the successful employment of ores in other districts. On the one hand the recent bad years had so manifestly disarranged mining undertakings that some time must elapse before the *status in quo* of 1871 becomes a possibility. The Bewdley Company, with their superb appliances and splendid machinery, are apparently unlikely to take speedy advantage of the altered position of the iron trade, arising presumably from the tardy proceedings involved in their "friendly" winding-up suit. This is the more regrettable, when, remembering the enormous outlay in the creation of their works, the lengthy suspension of operations, primarily owing to the depression in the iron trade, and, lastly, regarding the good values now characteristic of the industry alluded to. Parkend furnaces, located in the neighbouring valley of West Dean, are understood to have passed from the hands of Messrs. Crawshay to gentlemen whose reputed special attention will be directed to steel development, with the employment of foreign ores. It was near Parkend that Mr. Robert Mushet many years ago erected steel works, but which are now among the things of the past, and only known by repute to those associated with the industrial concerns of the Forest of Dean. The tinplate industry has maintained a steady status throughout the year, and starts with quotations 16s. per box for best coke; plate prices having given way to 15s., have since ascended to a maximum of 23s. Meanwhile, tin has advanced from £60 to £95 per ton, and material purchasable in January at 49s.—North of England—has reached a standard of 100s. With regard to the productive element of this industry, it will be interesting to state that in the month of March Messrs. Chivers and Company started their new mills in the Cinderford Valley, giving employment to a couple of hundred hands; and, as the year closes, Mr. Morris, of Britton Ferry, South Wales, has commenced tinplate manufacture at Parkend, where the mills had been closed, owing to the bad times, for a period of four years. Whilst there has not arisen the remarkable fluctuations in the coal industry characteristic of the iron branch, domestic coals during the last three months have been in active request, and the output for November and December, as anticipated, will be the largest remembered. On the other hand, during the summer period, and for several months, house coals were sold at prices never previously touched, notwithstanding the leading collieries were employed not exceeding four days per week. Wages among the iron miners and furnace men had yielded to successive reductions, so that in September the rate was 15 per cent. below that of thirty years ago. These employés have since been advanced, first 5 per cent., and second, only in December, 2½, with a further promise of 2½ in January. Colliers in the Cinderford Valley, who were advanced in January, 1879, and reduced to that extent in March, have since then received a 5 per cent., restoring their position of January, 1879, or approximately the old standard. Best classes of coal into trucks at the collieries are fetching 10s. 6d., and steam from 4s. 9d. to 5s. 6d. per ton. In the obituary record of the year, the Forest has suffered two great losses—viz., in January Mr. Thos. Goold, head of a leading firm of colliery proprietors in the Cinderford Valley, died, and was succeeded in the management of the collieries by Mr. Arnold Thomas; and, more recently, a heavy loss has also been sustained in the death of Mr. W. T. Crawshay, the well-known iron and colliery proprietor, who is succeeded by his sons, Messrs. Edwin and William Crawshay. In railway development, the Severn Bridge structure, with its connecting lines, has been opened, thus securing a new and immensely important route for Forest commodities; and in a short time the Great Western Railway Company will open their new northern outlet for the Cinderford Valley, securing a route to Hereford and the Midlands, by obviating a present detour of some twenty miles, inevitable in order to reach the districts enumerated.

Glasgow.

It will be remembered that, at the opening of the present year, the general trade of the country had been shaken by failures of unparalleled magnitude markets were lifeless and the future was clouded with uncertainty and distrust. Complications abroad, and political agitation at home intensified the evil, and were instrumental in deepening the distrustfulness of the trading classes. In these circumstances the prices of iron declined, and the workers' wages underwent a corresponding fall. This hopelessness pervaded our market for nearly three-fourths of the year; and when at length we were visited with some demand from the other side the Atlantic, prices advanced somewhat rapidly. The miners also improving their opportunity claimed wages that could not be sustained, and after some interruption they accepted the inevitable, and are nearly all at work again. Altogether, there is now more heart in the market, and it is pleasant to be to be able to note a general revival, not only in pig-iron, but in all kinds of manufactured iron and steel, as in ironfounding, engineering, &c. In shipbuilding, the prospects of 1880 are very encouraging, iron giving place to steel for its quicker sailing and larger stowage qualities; and of the vessels launched on the Clyde during the year (173,438 tons), 19,000 tons were constructed of steel, which appears to be the favourite "shipbuilding material of the future." The production of pig-iron, according to the ironmasters' returns, amounted in 1872 to 932,000 tons, against 902,000 last year, being an increase of 33,000 tons; and the prices fluctuated between 40s. (which was reached in July), and 68s. (which was the quotation on 6th October), giving an average for the year of 47s. 3d. per ton. The shipments of the year, foreign and coastwise, amounted to 540,518 tons; and there were forwarded by railway 23,482 tons, together 564,000 tons; while there were consumed in foundries and malleable ironworks 302,000 tons, making, between shipments and home consumption, a grand total of 866,000 tons, leaving a surplus of 66,000 tons to add to previous year's stock. The iron trade, it is true, has suffered considerably from continued depression, but fortunately we have a large accumulated reserve capital, and can consequently afford to work for a time at a diminished rate of profit. In the interval, the excess of stocks must have been swept away; and as we still retain our former advantages as to modes of production, superiority of appliances, and direct access to sources of supply, if peace were established, being in the path of the returning tide, we cannot fail to retain our full share of the world's prosperity.

Lancashire.

Although the year is closing with decidedly more encouraging prospects than those with which it commenced, the iron trade of this district has during the last twelve months passed through a period of depression more severe than has probably ever been known in Lancashire. The depression in trade during the previous year had brought prices down to a very low point, but this was followed during the first half of the present year by a fall in values which was altogether unprecedented, Lancashire makers having to contend with a keen competition from outside districts which almost threatened to drive local irons entirely out of the market. For Lancashire pig-iron delivered into Manchester the quotations in January were 49s. per ton. for No. 5 foundry, and 48s. per ton, for No. 4 forge, less 2½ per cent.; but Lincolnshire, Derbyshire, and Middlesborough brands were all being offered in the market at considerably lower figures, and before the close of the month local producers had to reduce their quotations 1s. per ton. They were, however, still out of the market, and notwithstanding an extremely limited production, stocks were rapidly increasing. Considerable purchases of English iron which were made during the next couple of months on German account, prior to the new tariff coming into force, tended temporarily to remove some of the pressure from outside districts, and the subsequent Durham strike had the effect of withdrawing Middlesborough iron from the market for a considerable period, but the demand had shrunk to such small proportions, that the downward movement in values was not arrested. In March local makers had again to reduce their prices, and they continued steadily falling month after month, until, in July and August, quotations for delivering into Manchester had receded to 43s. 6d. for No. 3 foundry, and 43s. for No. 4 forge, less 2½ per cent. These were probably the lowest figures ever known for Lancashire pig-iron, and even less money would have been taken by local makers to secure orders, foundry iron in fact touching as low as 42s. 6d. less 2½, but they were still undersold by other brands; and as iron was now being offered at less than the cost of production without attracting business, the blowing out of more furnaces, although not one-third of them were now in blast was seriously contemplated. With the close of August, however, came reports of large American orders in the market, and a considerable enquiry springing up for forward delivery, makers held out for their then list rates. The improvement, once set in, rapidly developed, merchants began bringing largely, and local makers not only blew-in additional furnaces, but early in September had advanced their list rates 2s. 6d. per ton, which placed their quotations for delivery in Manchester at 47s. for No. 3 foundry, and 46s. for No. 4 forge, less 2½, as compared with 42s. 6d. which they were willing to take to effect sales a month previous. This had a tendency to check business, but only temporarily; and outside brands, which had previously been competing with local irons, also moving rapidly upwards in price. Lancashire makers were not only able to maintain the advance, but before the close of the month were, notwithstanding their increased production, pretty fully sold, and in October further advances to the extent of 5s. per ton were made. The demand for iron had now increased to such an extent, and for forge iron especially, that more furnaces were put in blast, and in November prices were again put up 2s. 6d. per ton; this being followed during December by further advances of 5s. to 6s. per ton, bringing the quotations less 2½, when makers, being so full of orders extending over the ensuing three months, had practically to withdraw their quotation altogether pending the settlement of a further advance in prices. The improvement which has taken place in the Lancashire pig-iron trade during the last four months, has not only enabled local makers to clear off large stocks, but the production has doubled, 14 furnaces being now in blast as compared with seven in August, and the output is now so fully sold that preparations are being made to blow out others. The advance in prices during the same period has been fully 20s. per ton, and, as will be seen from the following table giving the quotations for delivery into Manchester during each month, they are 13s. higher than they were at the commencement of the year:—

	No. 3 Foundry. Per ton less 2½.		No. 4 Forge. Per ton less 2½.
January	49s. 0d.	..	48s. 0d.
February	48s. 0d.	..	47s. 0d.
March	47s. 0d.	..	46s. 0d.
April	46s. 0d.	..	45s. 0d.
May	45s. 0d.	..	44s. 6d.
June	44s. 6d.	..	44s. 0d.
July	44s. 0d.	..	43s. 6d.
August	43s. 6d.	..	43s. 0d.
September	47s. 0d.	..	46s. 0d.
October	53s. 0d.	..	52s. 0d.
November	55s. 0d.	..	55s. 0d.
December	60s. to 62s. 0d.	..	60s. to 62s. 0d.

In hematites the upward movement in values has been even more marked than in pig-iron, these having gone up from about 50s. to over 100s. per ton; and this is no doubt to be accounted for by one feature during the past year which cannot be passed unnoticed. This is the gradual substitution of steel for iron, and in one branch of local industry the manufacture of hoops; this has been particularly noticeable, the letter class of hoops being now made almost exclusively of steel.

In the finished-iron trade the improvement has been similar to that in pig-iron. For the first eight months of the year the depression in this branch of industry was extreme. In the majority of cases the local forges were not running more than half time, some of them even less, whilst several of the large works were closed altogether. Prices, which were very low at the commencement of the year—ordinary bars delivered into the Manchester district being then quoted at £5 15s. to £5 17s. 6d. per ton—had fallen in August to £5 to £5 2s. 6d. per ton, with makers competing very keenly for orders. Following the revival in the pig-iron market came an improved demand for finished iron, makers gradually filling up their books, until, within the last month, the orders coming to hand have been so numerous that most of the forges have now work on hand that will keep them fully employed for the next three or four months. Prices, which advanced slowly at first, have within the last couple of months gone up with great rapidity, £8 to £8 10s. being at the close of the year the minimum quotation for bars delivered into the Manchester district, with some makers refusing to quote at all, except subject to quarter day, or when they can deliver the iron.

The improvement in trade has, however, not extended, to any very material extent, to the other branches of the iron trade in this district, and founders, engineers, and machinists are not in any very much better position than they were at the commencement of the year. In these branches of trade the depression has been most serious all through the year, and in the earlier months the wages question gave rise to protracted struggles between the masters and the men. In the Manchester district a reduction in wages was amicably agreed upon amongst the engineers, but in the Liverpool, Birkenhead, and several other districts, this was not carried out without a strike. Whilst the boiler makers and moulders were, in some towns, out on strike for three or four months, with the exception of a few firms, who have been able to secure good foreign orders, or who have been engaged on specialties, there has been very little doing, and to keep work going at all, even on reduced staffs and short time, orders have in many cases had to be taken at prices which have barely covered the cost of labour and material. The depression in the cotton trade has naturally seriously affected the machinists, and the few orders received for new machinery have been mostly for export. Recently, the restarting of mills and other works has given employment to a larger number of men, chiefly in the way of repairs, but although the prospects for the future are more hopeful, the amount of new work coming into the district is still very small.

In the coal trade, the depression during the past year has also been very keenly felt, and although, during the last few months, there has been a decided change for the better, the improvement is not yet anything like that which has been experienced in the iron trade. The exceptional length and severity of last winter enabled colliery proprietors at the commencement of the year to obtain rather better prices for house-fire coals, but as the summer advanced, and there were still heavy stocks on hand, values rapidly fell. In January and February prices ranging from 9s. to 10s. per ton at the pit were obtained for the best classes of round coal, such as the Wigan Arley Mines, whilst for the second qualities, such as Arley and Pemberton four-feet prices ranged from 7s. to 8s. per ton, and common house-coal from 8s. to 8s. 6d., and common Arley and Pemberton four-feet at 6s. to 6s. 6d. per ton; whilst thecommon classes of round coal became a complete drug in the market, owing not only to the falling off in house-fire requirements, but to the general depression in trade, and the absence of demand for steam and forge purposes. For the inferior sorts as low as 4s. 6d. per ton at the pit was being taken, and it was exceptional where more than 5s. could be obtained. The prices ruling in the market were, in fact, so unremunerative that some of the colliery proprietors ceased working their common mines altogether. Engine classes of fuel have all through the year been bad to sell, the depression in the cotton, chemical, and salt trades, and the absence of brick making during the summer throwing large quantities of burgy and slack upon the market, and prices at the pit mouth fell to about 3s. 6d. to 4s. per ton for burgy, and about 2s. to 3s. per ton for slack, which was about 3d. to 6d. per ton less than was being obtained earlier on in the year. Pits were also all through the district put on short time—three to four days a week being about the average—while the majority of them worked for a considerable period during the summer. With the depression in values there was naturally also a fall in wages, and although only in a few districts was any general reduction put in force, the process was carried out more or less individually all through Lancashire. With the last couple of months of winter weather, the demand for house-fire coal has again been springing up, pits have got much fuller work, and there has been a general advance in prices to the extent of 6d. and 1s. per ton, but colliery proprietors are scarcely yet obtaining the prices ruling last winter. The improvement in the demand for house coal is only the natural result of the season of the year, and a more encouraging feature is the better enquiry which has recently sprung up for manufacturing classes of fuel. Common round coals for ironmaking purposes have been selling more freely, at an advance of 6d. per ton upon the prices above-named, and both burgy and slack have become firmer in price. The average quoted prices at the pit at the close of the year are about as under:—Best house coal, 8s. 6d. to 9s. 6d.; seconds, 6s. 6d. to 7s. 6d.; common coal, 5s. 6d. to 6s.; burgy, 3s. 9d. to 4s. 3d.; and good slack, 2s. 9d. to 3s. 3d. per ton. The miners have not been slow to take advantage of the signs of improvement in trade, and an agitation for an advance of wages has within the last few weeks been commenced in several districts. The colliery proprietors, however, having scarcely yet recovered the ground which has been lost, show very little disposition to concede higher wages at present, and it remains to be seen whether the men will force on a conflict which may severely injure the gradually returning prospects of trade.

LEEDS AND WEST YORKSHIRE.

Twelve months ago all reports as to the condition of the iron trade of this large district concurred in speaking of it as gloomy and almost desperate. And only three months since the hope of any appreciable and real improvement was cherished by but few. The Yankees, however, true to their traditional go-a-headness, gallantly showed the way round the corner, and our own ironmasters were enabled soon to discover that it was not all "bunkum" which was reported from Pennsylvania and other places as to the welcome reaction which had at last set in in the American iron trade. It was not long before the influence of a beneficent example—albeit it came to us from the United States—began to give heart of grace to our almost despairing British ironmasters. The revival of trade, so long anxiously hoped for, began to be felt in almost every other centre of the iron industry of Great Britain before Leeds and West Yorkshire had any of the same happy experience. But for the last six weeks both the employers and the employed dependent on the best Yorkshire iron trade have gladly recognised that a change for the better at last has been vouchsafed. The question now no longer is "What is to keep the wolf from the door?" but, "Will this promise of future prosperity be an abiding fact? What about the threatened extinction of the best Yorkshire iron trade by the substitution of steel for boiler and ship plates in the place of the best iron of such paramount toughness, and which has borne and triumphed over incomparable tests?" Well, there is no doubt that this is a question which has exercised the minds of our best Yorkshire ironmasters not a little. It is, in truth, the question of the hour. What is now only imminent is undoubtedly accepted in some quarters as a foregone conclusion. At all events, anyone would say so of an ironmaster who was heard to declare that his lease of minerals (than which there are none in England more valuable) had only to run a few years hence, and would just suffice until the time had arrived when steel would utterly have displaced iron for the purposes before mentioned. This is a matter of such great importance that it will justify our drawing particular attention to what the Farnley Iron Company have been providing in anticipation of this emergency, and how far they have succeeded or otherwise. Beyond all doubt, having but during 1879 erected apparatus for steel. making by the Siemens-Martin process, they have succeeded in making open-hearth steel of unquestionable quality from their own scrap; but it is feared that they cannot compete with that steel which is made from hematite pig and Spanish ore. One reason for this is that the black-bed iron ore (which is found in the neighbourhood of Leeds only, and which is unique as to quality) contains more phosphorus than is admissible in the making of steel such as alone can be accepted as a substitute for best Yorkshire iron. This remark applies, in fact, to other ores, such as the Middleton and Lincolnshire, which are the exclusive property of our Leeds and West Yorkshire ironmasters. Another thing which goes to the disadvantage of the Farnley Company as steel makers, is the too great distance of the place from the market, and the greater care and consequent expense which is necessary in the processes of manipulation by the workmen. These obstacles can only be overcome by the workmen being trained to the use of steel and using it conscientiously, it being so easy to spoil it. Up to the present time, however, it is claimed by our Yorkshire ironmasters that the adoption of steel in boiler work, and its exposure to fierce heat, has not been established so as to prove its superiority in that respect to the best Yorkshire iron. The makers of this iron have been doing a brisk trade recently, but in many cases the orders were sent simply because steel was so much in request for ship plates that boilermakers' orders could not be accepted. The best Yorkshire iron is never ordered much in advance, but still there is a fair amount of work ahead (at Farnley, for instance, which is one of the largest forges, and may be taken for our present purpose as representing what is the present business condition of other firms in the neighbourhood). During the year just closed, the output of finished work has not been far below what it was in 1878. The time worked has been less, but increased capabilities of production have enabled the output to be maintained, and the activity of the last few weeks has assisted very much to make the production equal to that of last year. The bar-iron trade has not been at all good, and is not good now—not even so good as it was at the beginning of the year. At the Monk Bridge Works (Messrs. Kitson's) a rotatory puddling furnace has been started during the year. It is upon the Crampton plan, but shows some improvements in details, and was manufactured by Schneider and Co., of Creusot. There have been two reductions of wages during the year, but not by quite all employers; but it is contemplated before long, if trade justifies it, to give back the reduction of 5 per cent. which was enforced about six months ago. The prices of best Yorkshire iron have been much lower than ever they were. This, in a great measure, is in consequence of the breaking-up of the union of ironmasters, which was intended to keep up the price-lists. The union may be said to have come to an end with the present year, because some of the members were underselling. A great improvement has taken place within the last two months, in the locomotive building trade of Leeds. But the year 1879 has been one of the worst, for this trade, of all the several years of depression. Prices have been exceedingly low, so low as to leave no profit whatever. The largest establishment devoted to this kind of work is the Airedale Foundry (Messrs. Kitson and Co.), and up to eight months ago the work was never slack there. Indeed, this firm never were busier than they were in 1877 and 1878, having obtained large orders for locomotives for India, because of the famine there. Large numbers of engines were required, and required to be supplied at a tremendous rate. Now they are moderately busy and very nearly full-handed. The depression in agriculture has been felt very much by Messrs. John Fowler and Co., of the Steam Plough Works. No substantial improvement is anticipated for some time yet. If the next harvest should prove a bounteous one, it will doubtless lead to a great extension of business at the famous works just mentioned. Machine-making has been pretty extensive during the year, but principally on Continental account. It is now also participating in the revival of the textile industries. There has been a good deal of regularity in the prices of coal, and stocks are not now heavy, owing to the caution shown as to production.

NORTH-WEST OF ENGLAND.

The review of the iron and steel trades of the North Lancashire and Cumberland hematite iron district for the past year is of an interesting and agreeable character, inasmuch as perhaps more than any other this neighbourhood has participated in the benefits of the general improvement which has taken place in the iron trade of the world. Well situated in respect to the development of a vast steel trade at a time when the steel age is fast approaching, and being situate in the midst of vast and valuable deposits of rich hematite ore, Furness and Cumberland are the most fortunate districts at the present time. They are all the more fortunate because when in August last trade began to show unmistakable signs of improvement, arrangements had been made throughout the district to participate in any change for the better which might spring up, by the remodelling of old furnaces, by increasing their capacity, and by the adoption of new appliances to facilitate productions. In many instances this work of progress was done during the dull times, and now all or nearly all this machinery is producing metal at the advance values of which iron is now quoted. The year 1879 found the hematite iron trade of the north-west of England in a very dull and unsatisfactory state. Iron was selling at 55s. per ton. at makers' works; only half the furnaces were in blast; and stocks of iron on hand were uncommonly large. There was on every hand an absence of confidence, and although sales could in many instances have been made, there was no good commercial groundwork to work upon. What is true of the iron trade at this time is also true of the steel industry, the iron ore trade, and the various other branches of industry, such as engineering, shipbuilding, &c., which are, more or less, dependent on the iron and steel trades. All the minor as well as the general industries of the district were not only indifferently employed, but the value received for the raw material and for the crude and manufactured article was exceedingly low, and in many instances unremunerative. As the year wore on anticipations were indulged in that the spring season, and the opening of the shipping trade would introduce a better state of things, and this, to some extent, was true, for large shipments of metal were made in April and May to the Continent and to America, but no appreciable improvement was noticeable except in the direction of the reduction of stocks. Prices remained at the low figure previously reported. Indeed, after a couple of months of the spring season had passed over, the tone of the market seemed to go down instead of rising, and at Midsummer the lowest point was touched, and Bessemer iron was then sold at 45s. per ton on trucks at makers' works. In the meantime a revival of the American trade brought several orders to this district; and notably a very large order for steel rails for a Canadian Railway Company, 30,000 tons of which had to be executed within a year or two at Barrow, and several thousand tons by a West Cumberland firm. These orders were accepted at a little less than £5 per ton. In August American consumers began to extend their operations beyond steel goods, and commenced to buy largely of pig-iron, and soon, with the aid of several orders from Russia, cleared out the whole of the stock of pig-iron, practically speaking, held in the district. In September prices had reached 55s. per ton, and as there was a large request for metal for shipment before the close of the shipping season in October prices made a further advance, and before November set in as much as 70s. per ton was given for Bessemer iron and 67s. 6d. for forge qualities. From this time to the close of the year there has been a gradual and constant upward tendency both in demand and in prices, and at present quotations stand at 110s. for best Bessemer qualities, 103s. for forge iron and 100s. per ton for inferior qualities. The rapid advance in value has been brought about mainly by American influence, and by sales made for forward delivery to that country and the Continent, and also to home consumers. Makers are, in fact, so largely sold forward at present that they have very little metal to sell even at the improved prices which are ruling. Steel makers are busily employed, and all their plant is running full time. Last Christmas, their mills were running only two or three days per week. Prices have gone up considerably during the year. Shipbuilders who had but little work in hand at the beginning of the year are now well off for orders. At Barrow, at present, the largest steamer in the world, save the *Great Eastern*, is being built for the Inman Line, 8000 tons burthen; and another steamship for the Anchor Line, 4500 tons, together with seven Admiralty orders, and other work. Engineers are very busy. Finished-iron workers are now full of work, but during the year they had very little to do. In the coal and coke trades a marked improvement has taken place in sympathy with the improvement in other departments of industry, and it is worthy of remark so far as West Cumberland is concerned, there has been a very considerable development of the coke-burning trade. The demand for coke has resulted in the erection of a large number of ovens, and the district is now less dependent than heretofore on Durham for its supply. The shipping trade has had a very brisk season, more metal having been exported at Barrow than ever, previously in one single year. As to the new year prospects in every department are of the most cheerful character.

North Staffordshire.

The first nine months of 1879 constituted a period of dulness in the finished-iron trade of North Staffordshire, varied only by occasional sparks of animation, and by more frequent and enduring intervals of depression approaching stagnation. The quiet which marked the opening of the year was interrupted towards the end of January by a fitful improvement, and in May a little flicker was caused by the receipt of a few foreign orders, and another flutter in the home market, both dying out almost immediately. Again, in July, there was an increase in business, which went on in a fluctuating fashion until the end of August, and was due to the convalescent condition of the English market, and in the last fortnight of the second month to a renewed demand from abroad. These were the bright spots in the dark chronicle of the first eight months of the year, and they were not of sufficient duration to materially alter the history of the period. Another interval of diminished custom, and then, as the end of September approached, commenced an influx of orders for the United States, which continued until near the close of the year, and was then only suspended, it is believed, because the plethoric state of the order books prevented manufacturers undertaking fresh obligations. It was not until November that the home trade showed signs of the improvement, without which the revival caused by the demand for America was regarded in some quarters as evanescent. Since then the demand for the home market has kept pace with the American requirements, and has inspired a wide-spread faith in the permanence of the new turn of affairs. Some large consignments of iron have also been made to Canada and Australia, but, on the other hand, scarcely any transactions with Russia, formerly an extensive customer, have taken place. So complete has been the revolution effected during the last two months of the year that not only has all the available plant in the district been fully employed, but orders have accumulated on the books in numbers sufficient to keep the works going for the first two or three months of the new year. Thus within the last twelve months was witnessed a change such as had rarely, perhaps never, before been experienced within a similar period. The year began with portions of the works occupied about half time, and ended with the continuous employment from Monday to Saturday of every bit of machinery capable of being impressed into the service; and the new year opens with brighter prospects than have ushered in any of its recent predecessors. But even with the unfavourable condition of trade during nearly three-quarters of the year just gone, North Staffordshire could bear comparison with other iron producing districts of the country in the amount of business done, and well maintained its good reputation in the market for the quality of its productions. It made no addition to the list of commercial failures, and when steel became talked about as a substitute for iron in engineering works, some of its manufacturers took advantage of the repose forced upon them by the scarcity of orders for iron to make experiments with a view to testing the capabilities of the existing machinery to produce the new material, and in the event of the prediction as to the future more extensive employment of steel being verified, North Staffordshire may be expected to be fully prepared to enter the list of its producers. At the beginning of the year, crown bars were quoted at £6 per ton, but by the middle of the year they had gone down to as low as £5 10s. for good lots. By the end of September there was a perceptible advance, and in the course of a month the price of crown bars had amounted to £7. At the end of the year they were quoted at £8 per ton, delivered equal to 50 miles, and it is confidently expected that the next quarterly meeting of the trade will order a further advance of at least £1 per ton.

In November, the wages of puddlers were advanced 6d. per ton, and of millmen 5 per cent., in accordance with the award of Mr. Chamberlain, M.P., and should that gentleman decide in favour of the men in the arbitration shortly to come before him as to further advance, the ironworkers of this district will receive another addition to their earnings.

The pig-iron trade was more uniformly depressed during the first eight months of the year than the finished-iron trade. More than once the make was reduced, to bring the supply nearer to the demand, but at nearly all the works forges were employed in making for stock, and some enormous quantities had accumulated by September. The heavy orders then received, however, soon caused a clearance of these stores, and enabled manufacturers to augment their production. At the end of the year all the furnaces in blast were in full operation, supplying current wants, and two furnaces which had been a long time out were being prepared to be relighted. There are still, however, a good number of furnaces in the district standing idle. The best quality of grey forge pig-iron was sold at the furnaces at the commencement of the year at 47s. 6d. per ton, but in June the price had fallen to 42s. 6d. By the middle of September it had gone up to 56s., and at the end of the year was quoted at 60s. per ton.

The ironstone trade passed through equal, if not greater, depression during the period referred to, and revived about the same time, and to a similar extent, as the pig-iron trade. Early in the year the Chatterley Iron Company closed four ironstone pits, which are still idle; but the other mines in the district have been for the last three months in full work, and the demand has been during that time equal to the supply. In January the price of ironstone was 13s. per ton. In the middle of the year it was 11s., but in October had again risen to 13s. In December it was quoted at 18s. to 20s. for good lots, and 22s. 6d. for smaller lots. A further rise is probable at the next quarter day, and sales of particular brands are suspended pending the decision of that meeting. In December wages were advanced 10 per cent. The demand for coal for manufacturing purposes was restricted until autumn, the china and earthenware trade of the Potteries, as well as the iron trade, being much depressed. The cold weather throughout the summer kept up a brisk sale of domestic fuel, which, however, is a small item in the total consumption. The revival of the iron trade and the improvement of the pottery industry brought about a rapid and complete change in the coal market. For nine months the pits were partially worked, and some were standing still, but during the last three months all were in full operation. Besides obtaining more work, the colliers have recently received an addition of ten per cent. to their wages. The price of coal has not fluctuated during the year, best manufacturing quality ruling at 10s. per ton at the pits with little variation, and house-fire fuel at 12s. 6d. Since the advance in wages the rates have been raised, and best manufacturing coal is now quoted at 11s. 3d., and best house-coal at 14s. 2d. per ton.

Sheffield.

The commencement of 1879 was marked by such a depression in the heavy trades of Sheffield and its immediate district as had never before been experienced in the commercial history of the town. It even exceeded the depression which followed the outbreak of the American war, and resulted in hundreds of working men being thrown out of employment. In their behalf it was necessary to create relief funds, as the sufferings of the working classes were intensified by the extreme severity of the winter. Scarcely had January passed by, there came heavy failures both in Lancashire and in the North. This brought with it a feeling of distrust which prevented any speculation, and almost paralysed the efforts of commercial men who sought to recover a trade which had apparently passed away. Following was a demand from the colliery owners of the district for a reduction of 12½ per cent. in the wages of their miners, and a strike would have supervened but for the reference of the dispute to arbitration. Ironworkers in Sheffield submitted to reductions of 5 and 7½ per cent. In the scissors trade reductions of 15 per cent. were allowed, and even in the engineering branches wages were lowered, though a stubborn resistance was made by this latter class. In March, steel rails were booked at £4 9s. 6d. per ton, and the mills were with difficulty kept running at thes prices. Bank failures and suspensions marked the middle months of the year, and then as autumn approached it was evident that the home trade had gone for the year. A bad harvest, agricultural distress, and symptoms of a yet downward course were noticeable in every quarter; still there were those who believed that the American market would revive, and following that revival would be prosperity to the commerce of Europe. Those opinions were stated in this journal and proved correct in their fulfilment. Heavy orders for steel rails were received, and in September there was at least 30 per cent. more work doing than at the opening of the year. Iron commenced to rise, but it must be remembered that in this district many of the smelters, in order to keep their plant employed, had accepted large contracts at the low prices of June. Thus for a time they were sufferers, as they had to pay increased rates for raw material and in wages. The upward course of business was extremely rapid, and the ironworkers were not long before they obtained a concession of 5 per cent. in their wages. The closing months of the year were marked by extreme confidence, and a determination on the part of the public to re-invest in the limited companies from which they had withdrawn. In Sheffield alone, the increase in the value of share capital held by the "limiteds," had, in the last six months of the year, risen by £2,271,062. The coal trade appears to be the only one which has not benefited by the revival, nor can we state that at the present there are indications of greater prosperity in this department. The coal trade is bad. File houses have cleared off a large amount of old standing stock into Germany, and edge-tool makers are fairly busy. The skate trade is very active, but in cutlery there has been a revival in the trade of several foreign markets, which has done much to improve the condition of things; still the home market is depresed, and only a few firms are enjoying the amendment which is noticeable.

South Staffordshire.

The close of the year 1879 finds the iron and coal industries of South Staffordshire in a much better position than they have been for some years past. So recent, however, has been the revival that even so late as August there was nothing to indicate the approach of the improved state of things. It was only at the commencement of the last quarter that, at any rate, finished ironmasters were able to report themselves as doing more.

The first two quarters of the year found the ironworks doing only a comparatively retail business. Quotations at the same time were declining. Prices of high-class bonds were regulated by £7 10s., for marked bars, with the usual 12s. 6d. extra for Earl Dudley's make. Sheets (singles) ranged from £8 to £7 10s. and £7. Common bar prices were not marked by a wide margin, standing for the most part at £6, but an order at 5s. under this figure would not have been refused. In fact, such bars could be got at £5 12s. 6d., a price almost unprecedented in the memory of the oldest ironmaster in the district. American orders were received in Michaelmas quarter, and the home demand for hoops, strips, and bars, also began to improve. In the same three months galvanising sheets began to move, and an increase of from 5s. to 10s. upon the minimum was asked, and in many cases obtained. As the result of the rise in spelter, most of the leading galvanisers put up their price for sheets between £1 10s. and £2.

The quarter just concluded saw a rapid rise in all kinds of unmarked iron, together with more employment for the men. Prices were put up from 10s. to 20s. per ton, and a similar advance was again made in galvanised sheets, making best brands of 24 W. G. packed, delivered in London, £17. The marked iron firms were in November able to keep their works going longer, and an advance of 10s. upon bars brought the quotation for this class of iron up to £8 and £8 12s. 6d. The revival went on, and with the advent of December it was not possible to place orders for long-forward delivery at any price. For sheets (singles), £9 was asked during December, whilst lattens stood at £12 10s, and in the same month best sheets were quoted up 20s. Quarter day will see still further advances in all kinds of iron.

As to pig-iron, it is to be reported that 85s. per ton for cold-blast all-mine was the quotation at the January quarterly meetings, and 65s. for hot-blast all-mine. £2 2s. 6d., and £1 18s. was asked for common cinder iron. These prices ruled during the first half of the year. The competition of Lancashire, and Derbyshire, and Northampton makers with native producers was keen, but during the last half of Lady Day quarter the competition from the North of England was lessened by the rise which then occurred in the price of Cleveland iron. The Midsummer Quarter closed with 27 furnaces in blast, leaving 120 standing idle. In September a revival set in, and the heavy stocks which were upon hand began to lessen, and prices stiffened. The commencement of the Christmas quarter saw an important move upon the South Staffordshire market. Flags both in Barrow hematites and the Tredegar (South Wales) best pigs. The price at this period was 72s. 6d. for Barrow, and 70s. for Tredegar, but at date even as much as 105s. and 110s. is not an extraordinary quotation. Native pigs advanced likewise. Furnace coal in November was advanced 1s. per ton, and in the following month another 1s. per ton was added, making it 10s. This, with the great demand for forward delivery, has had the effect of inducing pig-makers to hold their stock, and to close their books until after quarter day. The prospects of the South Staffordshire iron and coal trades for the New Year are in every way encouraging.

THE IRON TRADE OF THE CONTINENT IN 1879.

As the year which has just closed was the fiftieth anniversary of the invention of the locomotive—an invention built up of ideas indisputably English in origin—it may not be out of place to reflect that fifty years ago the iron trade of the Continent had a proportion to that of England altogether different from its proportion of to-day. It would have seemed, in the first quarter of this century, as if the English manufacturer had been granted, by natural conditions, a monopoly of the markets of the Continent. Inventive faculty and industrial energy, the geology and geography alike of the British Islands, were elements of a supremacy on the Continent which it might well be thought would never be disturbed. No one large thought in connection with the manufacture of iron has ever had birth on the Continent. The metallurgy of iron is a Great British creation, and British ironmasters and mechanicians might fairly reckon at least on all the advantages to be got by being first in the field. In 1825 bar iron cost 300 per cent. more in France than in England. Mining operations were conducted with great skill in the latter country; labour was well organised, and sundry collateral advantages accrued from the gathering of large manufacturing populations in industrial centres. It was considered the natural state of things that the Continent should depend for its mechanical appliances entirely on Great Britain, and this ungenerousness was in itself an advance upon earlier ideas. For, according to them, it was the privilege of Great Britain not only to invent machinery and make it, but to use it as well, in the production of manufactures of which British workmen were to have a monopoly. Only in 1824 was repealed the Act prohibiting English mechanics from accepting employment on the Continent; the prohibition against the exportation of machinery remained in force a few years more. By and by English capital found employment on foreign soil for English skill, and English machines made their appearance one by one in the various countries of the Continent. The inventions of Cort and Neilson were introduced, together with the English system of the manufacture of iron, by English men and English money in such places as Creusot, in France, and Seraing, in Belgium. English machinery of all kinds began now to be scattered over the Continent, which was still so helpless, mechanically, that we may here, perhaps, ask where it would have been had English inventiveness been as dormant as its own? In 1834, Thiers denounced Stephenson's invention as a toy; and, so late as 1840, Germany was building the "Saxonia," the first locomotive constructed in a German workshop.

With such late, and small, and second-hand beginnings on the Continent—without hereditary skill, without political settledness, without the English freedom of trade and labour—it is matter of surprise that the iron trade of the Continent should have attained its present dimensions; that a Prussian steelmaster should become the second richest man in a population of forty-two millions, while the British ironmaster is content to persuade Frenchmen, Belgians, and Germans to buy his pig. The reasons for this alteration in respective position, it is not our province here to enter upon; but it seemed to us advisable, now that we have to take the Continental iron trade into account as a very large fact, to urge on the consideration of the English technical public the development of that trade, so far as it has gone, and to invite attention to the possibility of further developments, and to their probable causes.

In its economical aspect, the iron trade of the Continent differed greatly at the end of 1879 from its condition at the end of 1878; all through the latter unfortunate year a shrinkage had been going on of work and profits both, and losses of capital had been very large. Some good, perhaps, of a negative nature, was done by the ruthless destructiveness of one of the worst years known to the trade. A great deal of the mischief caused by the rash speculations of 1872-3 was swept away in 1878, which made havoc with a large number of unsound and unnecessary establishments, whilst it pruned and strengthened more stable firms which had been only slightly tainted by the rank prosperity of the industrial mania.

Gloomy as were appearances at the end of 1878, there was little to relieve them in the earlier months of 1879. The crisis went on, and bad became, in many cases, worse. In France the situation was more tolerable than elsewhere in Europe, and balance-sheets made up from July 1st, 1878, to June 30th, 1879, did in a good many cases show fair profits. The conservatism and timidity of French trade had acted as a bar against its undue expansion during the factitiously busy period which supervened on the war. Capital had not been allowed to crowd in; wages had been kept down all through, and the Exhibition itself had directly and indirectly a beneficial influence on trade. The large steel works in the Rhone and Loire still had work in hand for the railway companies under very large contracts—some of them running for some four years altogether, and so were kept in employment without fresh business. The depression was most severely felt in the north and east. In February last beams were quoted at Nord mills at 140 fr., and were still falling. They were 125 fr. in Belgium at the same period. It had not escaped our notice, however, that the autumn of 1878 exhibited symptoms of improvement, and a revival had begun in hope long before it had begun in fact. In September of 1878 expectations of better times began to be formed, and by the spring of 1879 these expectations began to be realised. We invite attention to this statement, which a reference to our foreign reports will justify, since it is of some interest to reflect that the market had begun to turn in Europe before the harvests were reaped in America which, in common belief, form the basis of the present European revival. But, in fact, trade began to turn in America itself before 1878 had run out.

Belgium was not slow in following France in the revival, which was so faint at first that it escaped general notice. But prices were still low in the earlier months of 1879; in March the Cockerill Company was content to take 128 fr. 70 for Bessemer rails 9 metres long, and in April, as we have been plentifully reminded, the State thought 129 fr. too dear for 12,000 tons of rails which it had to offer. Common beams were quoted at 120 fr., while there was a stock of pig on hand of 120,000 tons. During the spring, although prices began to be firmer, furnaces were put out of blast, and a mill was here and there closed. In several cases the June balance-sheets showed a loss instead of profit. In May, Bolckow, Vaughan and Co. and Cockerill were in competition for steel rails for the Alta Italia Railway—11,000 tons. Cockerill came a little under Bolckow, Vaughan and Co., the Belgian firm offering at the rate of £4 9s. 6d. at the works. Another offer made by Cockerill about this time was for iron and steel rails at the same rate, at the option of the buyer.

That the present brilliant prosperity of trade was not foreseen in Belgium, or at least in Hainault, is only too true. In February an ironmasters' petition from Charleroi was vigorously repulsed by M. Sainctelette, the Minister for Public Works, who told the petitioners not to persist in the prosecution of a trade which had no future. On April 23rd, however, another petition was sent up from Charleroi in terms most astoundingly abject, beseeching the Minister to order goods to keep the mills going, and the men from starvation and revolt. If in France the putting in hand of public works laid the foundation of the revival in that country, the Government of Belgium has also assumed the paternal function of finding occupation, so far as it can, for its subjects, and very large orders on account of the Government, the largest railway proprietor in the country, were given out during 1879. In Belgium, as in Germany, the use of iron for rail supports has been adopted on a large scale, and several thousand tons of make went to Charleroi in consequence of the displacement of wooden sleepers by metallic contrivances.

Later than Belgium in giving evidence of the revival which made the autumn and winter months of 1879 conspicuous, was Germany. During 1877 and 1878 a large number of failures had occurred in the iron trade, as in many others, and there was a considerable amount of poverty amongst the working classes. That this state of things was one of the results of the foolish investments in the iron manufacture made in 1872-3, complicated with the exhaustion consequent on the war, no reasonable German has ever disputed. But this state of things had to be remedied, and the remedy nearest to hand was a return to protective duties. In the autumn of 1878, a parliamentary committee was appointed to take evidence, as to a matter of form, on the condition of the iron trade, and the re-imposition of the duty on imported iron—a measure really fought for from May, 1875, onwards—was effected on June 1st, 1879, under the championship of Bismarck. The only free years were 1877 and 1878; it was not supposed at first, that the re-imposition could take place before 1880. In December, 1875, and in April, 1877, the measure carried in May, 1879, was rejected. Large quantities of English pig were thrown into Germany in the spring of 1879. It is a curious fact that the imports kept well up throughout the year; the duty they have been loaded with since June has not, therefore, checked their inflow. There is one remark to be made, however, in this connection, which is applicable to the whole iron trade of Europe. The total make of each country, in 1878, as in 1879, if it has not reached the extravagant weights of 1872 and 1873, has, generally, come up to the level of the years immediately preceding those dates, and an amount of work has been done which, left to fewer hands to do, would have made those hands very busy. Even in Germany, where the years of inflation are looked on as having fixed the standard of make, more iron was made in 1878, and more hands were employed in the iron trade, than in times considered normal, times in which "starving millions" and "threatening revolution" would have sounded like the rank nonsense they are.

Of the trade of Austria it is not possible to say much. The period of depression has been prolonged all through 1879; and although there is now some token of improvement, it is probable that the trade of Austria, in the spring of 1880, will only occupy the position relative to the revival achieved by France in the spring of 1879.

We now proceed, by the help of a few comparative prices, to trace the brighter outlines of our view of Continental trade.

So early as last February, the position of the iron trade of France could be described by us as one of "expectancy veering towards hope." Rates for beams at the beginning of February were 150 fr. in Paris, 140 fr. in the Nord, and were held weakly. By the end of March prices had ceased to fall. In April, Nord makers had already syndicated themselves for purposes of offence and defence, and, by a *coup de main*, carried rates up 5 fr. Business, as soon as the market showed a mind to rise, began to come in, and the hands of the Nord were thereby strengthened. As the season opened, beams became scarce at Paris, and in May they were quoted at 190 fr. As one quarter passed away after another, it was found that the imports were declining, the exports rising, the presumption being that the home trade was getting active enough to supply the wants of the home market, and rather more. A certain slackness crept in towards the end of the very unfavourable summer, but the market was strengthened in the autumn by the sudden and swift rise in the markets of England and Belgium. In October beams reached 195 fr.; irons had been put up almost continuously at every monthly meeting held by the syndicate of Northern forgemasters; but it was not thought advisable to raise them during the winter months, in view of the inevitable pressure of spring requirements. Business was also checked at the end of the year by strikes in the building trades and Belgian coal trade, and by abnormally severe weather. The year's market for beams, therefore, which opened weak at 140 fr., closed firm at 195 fr. Pig lagged behind merchant iron, and common qualities of Meurthe and Moselle forge pig were purchasable at 52 fr. to 54 fr. all the year through. The make of those two departments is, however, sold forward to the end of next June. In Haute-Marne the rise in foundry pig was from 77 fr. in 1878 to 95 fr. in 1879. In the eastern departments most branches of the iron trade are working together jointly under the control of syndicates.

It scarcely need be pointed out that the return to normal rates is more profitable now than it would have been a few years ago, in consequence of the various economies introduced into methods of working.

Belgian prices for finished irons ruled at the beginning of the year from 10 fr. to 15 fr. below those current in France. A profound sensation was caused in both markets in February by the famous Sheffield (Dronfield) tender of £4 9s. 6d. for steel rails. But Belgium declined to allow itself to be beaten in prices, and manifested through all the crisis great resolution in the suppression of profits. The lowest point touched by rates in Belgium was during the winter months of 1878. Rates, which continued for some time nominal, went on gradually hardening until the following contrasts were obtained:—

	Nominal rate.	Rate on Nov. 15.	Rate at end of December.
White pig	50 fr.	60 fr.	85 fr.
Merchant irons ..	115	145	180
Steel rails	120	145	190

The rise in rates during November and December was one of the most rapid known in Belgium. English competition was checked by the blocking up of Antwerp by ice, but is likely to make itself felt in 1880.

Several fresh furnaces have been put on blast, not on speculation, but to work out contracts. The extent of the improvement may be also seen in the rise in value of industrial securities, as shown in the following table.

No. of shares.		June 10.	Dec. 10.	Dec. 27.
		fr. c.	fr. c.	fr. c.
15,000	Cockerill (Seraing) ..	810 00	1110 50	1195 00
15,000	Espérance	57 50	214 50	256 50
36,500	Marcinelle et Couillet	217 50	400 00	—
24,000	Met. et Charbonn. belge	45 00	121 00	158 00
11,250	Ougrée (d')	257 50	572 50	640 00
22,000	Sclessin	127 00	177 50	382 50
2,000	Athus	1150 00	1600 00	—
12,000	Forges d'Acoz ..	75 00	335 00	410 00
4,813	Monceau-sur-Sambre	510 00	900 00	—
3,500	Ougree (fab. de fer d')	465 00	975 00	—
6,650	Providence	1100 00	1575 00	1700 00
2,000	Saint Léonard (outils)	560 00	560 00	—
5,300	Sarrebruck (forges de)	2300 00	3200 00	—
2,700	Thy-le-Château ..	1300 00	1925 00	—
9,000	Vezin-Aulnoye ..	210 00	335 00	—

The Belgian market, in which the best customer is the State railway directorate, profited by the American demand for scrap which sprang up in the autumn. Holders were paid as much for old rails as a few months before they would have taken for No. 1 irons. The State sold off its stock of old rails, and was thus compelled to pay cash all through for new business, an arrangement which has turned to the benefit of smelters. A temporary check to Belgian prosperity has occurred in the serious strikes in Hainault, in which some 20,000 miners are involved.

December prices as compared with those of June, show in Germany a rise of 10 to 15 per cent. in merchant iron, in forge pig from 20 to 25 per cent.; in Bessemer rails about 20 per cent. In June, 120s. was all that was asked for Bessemer rails; at the end of November tenders were let by the Silesian Railways on the footing of 148s. at the works. This price is about that paid in June, 1877; in June, 1876, 170s.; in June, 1875, 210s.; in June, 1873, 400s. was paid for the same class of goods. The maximum ever got, even in 1873, for Bessemer rails, was 425s. Any return to "fancy" prices is of course out of the question; but the rates now got are sound. Furnaces are being put rapidly in blast in Westphalia; and the rise in requirements for fuel are estimated to be such as will compel the lighting of some 800 coke ovens in Westphalia between the new year and next midsummer.

America has bought fine iron in the Ardennes, scrap in Belgium and Germany, and Bessemer billets in the latter country. Puddlers for America have been advertised for in Belgium.

A state of struggle between free trade and protection continued throughout the year, the balance of victory inclining to the retrograde principle of protection. The evil doings of Germany are notorious; in Belgium a petition to abolish the duty on imported pig was rejected; Spain, Italy, Russia, and Austria strengthened the barrier of their tariffs. In France the struggle will presently be renewed; its issue is doubtful. This is, however, of comparatively small moment. The legislative enactments of the French do not pretend to the durability of those of the Medes and Persians.

The opening-up of foreign markets is a matter to which earnest attention is being given on the Continent. France is pushing into northern, Belgium into Central Africa. Germany has endeavoured to find a *ποῦ στῶ* in the South Seas. The English annexation of the Transvaal was a matter of disappointment to many Belgians, who hoped to negotiate, in Flemish, a great deal of Boer business. The investiture with commercial functions of consular agencies has been urged on the attention of Continental Governments, and doubtless paid consulates will have to be considered in the future as business outposts. The opportunities of pushing trade offered by international exhibitions in English colonies have not been and are not being neglected. Belgium has succeeded in making its way into the markets of the East, Turkey, China, Japan, and three of the South American States. Not only are clerks and merchants carefully trained for counting-house work, but are equipped with a sufficient amount of science to make enterprise easy. At Antwerp and Liege young men are trained in commercial and technical geography, and become acquainted with the natural products of the various parts of the world, their uses, facilities of export and import, and so on, acquiring in a three years' course as much information as it takes the shrewd head of a British counting-house a lifetime to pick up. And with this careful preparation for the foreign is joined resolution to retain the home market. Recrimination as to rival qualities of make in Belgium is constant; in Germany English and Scotch foundry pig and fuel have been made the object of elaborate tests, instituted with the foregone conclusion of proving the superiority of native products.

The progress of invention on the Continent has not been marked by any great novelty, if we except the "industrial revolution" which M. Testud de Beauregard has yet to accomplish, but the active intelligence, the application of which to commerce has been noted, has quickly grasped the solution of the dephosphorisation problem offered by the English inventor of the basic Bessemer process. The managers of the Hörde Steelworks, in partnership with those of the Rhenish Steelworks, promptly assured themselves of the value of the process brought out under the joint auspices of Messrs. Thomas and Gilchrist, and patented by the former gentleman, and took early steps to acquire Mr. Thomas's patent-rights for Germany and Austria. The experimentation carried out at Hörde gave such satisfactory results that at the time of writing (Jan. 1, 1880) there are four converters in steady work at Hörde, running on a very cheap and highly phosphoretic Westphalian pig as well as on white Cleveland iron. At Ruhrort two vessels are running on Cleveland iron. At the Angleur steelworks there is one basic converter kept at work on phosphoretic Belgian and Luxembourg pig of low quality, and another will be lined immediately. There are two converters in use in Austria, where results have been attained parallel with those described with so much enthusiasm by Mr. Massenez, the manager of the Hörde works. At Creusot and Neunkirchen, in the Palatinate, Mr. Schneider and Baron Gienanth, respectively, are operating with one basic converter each. Allowing ourselves a momentary return to England we find the position of the Thomas-Gilchrist process, as testified to by the number of converters adapted to it, to be as follows:—

	Converters.
In Hörde, Westphalia	4
,, Ruhrort, ,, ...	2
,, Neunkirchen, Palatinate	1
,, Witkowitz and Teplitz, Austria	2
,, Angleur, Belgium	1
,, Creusot, France	1
,, Sheffield, England	2
,, Eston, ,, ...	?

Omitting Eston, at which two new 10-ton converters, specially built for carrying out the process on an industrial scale, are now approaching completion, we find that practical working is now going on continuously in 13 converters, under several independent managements, in places far remote from each other. Of the total number of converters six, like those of Sheffield, are 8-ton vessels, the out-turn from which has been several thousand tons. The presence of sulphur to the extent of ·4 per cent. and of phosphorus to 2·75 per cent. has been found no obstacle to the production of excellent steel. At Witkowitz and at Hörde the tests to which the finished metal were subjected were both severe and satisfactory; at Angleur, as at Eston, the metal has been found to make not only rails but wire billets and tires of unexceptionable quality. The spread of the process on the Continent was interfered with by a formidable coalition of some of the largest iron and steel concerns of Germany, who united their forces in a joint endeavour to overthrow the patents already taken out in connection with the process in Germany, and to impede the granting of any others to the patentees. This coalition was willing to pay down £150,000 on consideration of the patentee not defending his claim; but with great resolution he declined both conditions, and succeeding in making his claim good. The directors of the Hörde works invited the Imperial Government to investigate the process on behalf of the nation, and Dr. Wedding and Professor Finkener have collected at Hörde very numerous samples, which they will test and report upon. Meanwhile, the process is making way, as is evident from the negotiations now going on with various works, and the fact that in Germany alone six firms have taken out licenses. Three of these firms are building Bessemer works for the conversion of the cheap pig of Luxembourg and Alsace-Lorraine. Three firms in Austria have arranged to work on the new system. An undertaking of exceptional magnitude, based on the Thomas patent, is in course of elaboration between the two great forgemasters, Schneider and De Wendel.

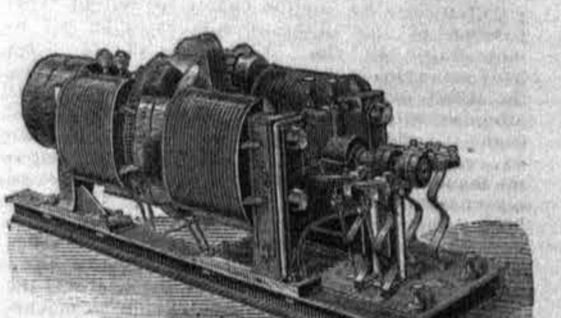
The keen promptitude with which the course of English invention is followed on the Continent, while it is, of course, a tribute in honour of English inventiveness, is itself deserving of English recognition. The careful utilisation of all means of improvement, large and small, the steady industry, above all, the consummate technical training enjoyed by the officers of works in even the humblest positions, have availed to create, in the face of native disadvantages and English competition powerful industries. There are now blast-furnaces and rolling mills in Spain, large engineering works in Italy and Switzerland, steel works, splendidly equipped by French engineers, in Russia, there are nearly three hundred blast-furnaces in Austria. As for countries nearer home we can form some idea of the magnitude of their iron trade by considering the numbers of the hands which in each find employment in it. Germany employs, in round numbers, 100,000 hands, excluding miners and mechanicians ("engineers") in smelting and finishing iron; Belgium some 20,000. In 1878 France made a million and a half tons of pig-iron, 805,741 tons of iron, and 289 327 tons of steels—2,592,914 tons in all of manufactured goods. In 1800 France made only about 100,000 tons of pig-iron.

We venture to think that the very considerable total value of the Continental iron and engineering trades would never have been reached had our Continental neighbours been content with the rough-and tumble "systemlosigkeit" which has too long characterised the operations of the energetic but often artless Englishman. If Continental trade be not a reproach to English enterprise, it is a powerful argument in favour of technical education.

THE BRUSH ELECTRIC LIGHT.

We last week briefly referred to some experiments which had been carried out with a new system of electric lighting, the invention of Mr. C. F. Brush, of the United States. This system has occasionally been heard of on this side of the Atlantic, but this is its first appearance in England. It is being introduced by the Anglo-American Electric Light Company, of 74, Hatton Garden, London, where the experiments to which we have referred were successfully carried out last Tuesday week. The system embodies important improvemements and advantages in the three essentials necessary for electric lighting, viz.—the generator or dynamo-electric machine, the lamps or carbon regulators, and the carbons. The accompanying engraving represents one of the Brush dynamo machines, which are made in several sizes, capable of operating from one to 16 lights in a single circuit. In construction, the machines differ from all others, both in the armature, the arrangement of the field magnets, and the commutator, and the novel mode of connection. It is stated that this arrangement produces from a given amount of power a larger available current than has hitherto been obtained from any other combiuation. At the same time the wear and tear is reduced to a minimum, the wearing parts (the segments of the commutator and brushes) being easily replaced when necessary at a trifling cost. The current produced is continuous, and of such a nature as to enable it to overcome a great external resistance.

The most prominent peculiarities of the machine are embodied in the armature, the arrangement of field magnets, and the commutator. The armature consists of a flat ring of soft cast-iron, revolving in its own plane. This ring is composed of several parts, each provided with a series of grooves and insulated from each other, so as to effectually prevent the induction of currents in the iron itself when it is revolved in a magnetic field. On this ring are wound bobbins of armature conductor, the planes of which radiate from the axis of rotation. The field magnets of the machine face both sides of the armature in the plane of its rotation, thus both sides of the flat bobbins of armature conductor are exposed to the direct inductive influence of the magnets. The commutator consists of four separate rings of metal, each ring consisting of two nearly semicircular segments, the ends of which on one side are separated by a considerable space. This space is occupied by a metal insulator attached to an adjoining ring. It is insulated by an air-space from each of the segments between whose ends it is located, the other ends of the segments being simply separated by a single air-space.



The lamps or regulators hold the carbon rods in a vertical position and contain no clockwork or other mechanism, and no regulation or adjustment of any kind is required beyond that of renewing the carbons when consumed. By means of a magnetic control and automatic cut-off arrangement each lamp, though in continuous circuit with many others, is independent in its working. Thus, a mean length of arc and equality of light and consumption of carbon is always maintained. The "cut-off" effectually guards against all dangers of general extinction. Should any one lamp in the circuit be accidently injured or thrown out by the consumption of the carbon or from any other cause, the remainder are not affected. There are several forms of lamps, all embodying these important features, but differing in construction according to their intended use.

The special features and advantages of the Brush system were fully demonstrated at the recent trials when several machines of varying sizes were exhibited. The machine used upon this occasion was a No. 7 Brush dynamo, working 16 lights in one single circuit of wire, which consisted of 250 feet of No. 9 B. W. G. copper wire conductor. During the demonstration the current was switched into a circuit of similar wire, one mile and a quarter in length, *plus* the 250 feet of short circuit, without apparently in any way affecting the brilliancy of the sixteen lights. The machine was driven by an 8 horse-power portable engine made by Messrs. Wallis and Stephens, of Basingstoke, and indicating 13½ horse-power. The engine worked with 50 lb. steam pressure and ran at 125 revolutions per minute, the dynamo-electric machine making 750 revolutions per minute. The results of the exhibition were very satisfactory, the lamps giving a clear, steady light, the steadiness being promoted by the use of carbons, which are specially made for the Brush system. During the past year this system has been largely adopted in the United States with very satisfactory results, there being now more than 800 lamps in use there. They are in considerable demand for lighting mines, iron works, mills, and factories, some 40 of these establishments being lighted by them. It is from practical use in one of these factories that some definite idea of the cost of this light is gained. In one establishment the cost of gas is stated to have been 16s. per hour, at 4s. per 1000 cubic feet. The Brush light is now doing the same work as the gas did at a cost of 4s. per hour, steam power being available at the works. Where engine-power has to be provided, the actual total cost, including interest on machinery, labour, fuel, maintenance, and carbons, is placed at something less than 2d. per light, per hour. This estimate is based upon experience obtained in working in the United States, which has also shown that the system can be used under various conditions with advantage and economy. An example of its use in public lighting occurs in the Monumental Park, Cleveland, Ohio, where 12 lamps illuminate an area of 12 acres filled with trees, displacing 100 4½-feet gas-burners. On the whole, the Brush system appears to be one of much promise, and likely to obtain a considerable share of patronage and support.

TRADE SUMMARY.

THE present holiday season has, as usual, interfered to a considerable extent with business in all departments of the coal and iron trades; but the pressure of orders in the latter is so great that operations will probably be resumed in many places after a briefer interval than ordinary. Generally there is no cessation of inquiry in the markets, and rates remain firm as regards iron, where they are not going up. Glasgow warrants are reported as having been very strong during the week, notwithstanding the large increase in stocks. This state of the market was mainly occasioned by the belief of an excessive demand in the spring, accompanied by an unexampled rise in prices; and there were rumours also of a renewed demand from America, either set afloat from speculative motives, or proceeding from the wish that is father to the thought. On Wednesday the closing prices for pig were 67s. 3d. to 69s. 9d. cash. There has been a further advance in makers' prices. In the manufactured iron trade the works have a sufficiency of orders for a good while to come; prices are firm at £8 for common bars, which is a rise of about £3 a ton since the commencement of August. The position of the engineers and founders is still improving, but the shipbuilding orders seem to have slackened. Notwithstanding the season the Middlesborough market on Tuesday was well attended, with prices firm and hopeful. Forge iron, from its scarcity, is in great demand, and prices have risen correspondingly. There is more doing in the foundries, and with plentiful orders and engagements for some time to come, the finished-iron trade is maintaining a firm tone. At Manchester, the same day, there was little more than a nominal market, which is accounted for by the small quantity of iron for disposal, most of it having been sold forward. The same cause, also, affects the South Lancashire finished-iron trade, although prices, nominally, are very firm. This anticipative condition is especially marked in North Lancashire and West Cumberland, where makers have sold so well forward that they hvae little left to dispose of, the orders at present held also representing a very large aggregate of metal. Thus favoured by fortune, it is not surprising that even high prices cannot always induce makers to accept orders at current rates. Best qualities of Bessemer iron have been sold at makers' works as high as 100s. per ton, and 97s. 6d. given for best forge. Prices at Barrow are, of course, higher, all-round qualities of Bessemer bringing 110s. f.o.b., No. 3 f.o.b. 105s., and the inferior qualities of hematite iron 100s. This satisfactory state of things is urging forward the construction of new furnaces, all the old ones having been for some time in full blast. Iron ore is also becoming difficult to obtain, and is selling in some cases as high as 30s. a ton at the mines. The best Yorkshire iron forges are again in full blast, after an exceptionally short holiday, and the boiler plate trade is reported as particularly brisk. The engine and machine trades are likewise in fairly good case. Although comparatively little has been done in certain of the works in the South Yorkshire district during the week, the blast-furnaces have been kept constantly going, and have turned out a large quantity of excellent pig. Some good orders for Bessemer steel have been received, especially for railway purposes. Both in North and South Staffordshire the condition of the iron trade is satisfactory. In Derbyshire additional furnaces have been blown in, and the output has been proportionally increased. As regards the Sheffield local trade, although the workmen have scarcely got through their holidays, there is good prospect of the improvement previously remarked continuing into the new year. The Birmingham special industries, on the other hand, appear to be in a condition far from satisfactory. Tube makers, however, seem very busy. In the neighbouring district, of which Wolverhampton is the capital, the foreign orders recently received have been small; but prices are hardening, especially in hollow wares. In South Wales matters are brightening, the output from Cyfarthfa becoming larger than ever. The Forest of Dean seems to be holding its own in the face of the South Wales competition. Some descriptions of coal are in fair demand; in others it is the reverse, and there is little improvement in prices anywhere.

THE NEW ENGINES AND PLATE MILL AT THE LOW MOOR IRONWORKS.

THE Low Moor Ironworks were founded in 1788, but it was not until the year 1791 that the first cast was made there. From that date down to the present they have maintained a reputation for the production of the highest class of iron. The uniformity of their material is produced by the almost exclusive use of the well-known Low Moor beds of minerals, called the "better bed" coal, and "black bed" ironstone. These combined in the furnace in certain proportions with Skipton rock limestone as a flux, produce the well known Low Moor brand, the resulting pig-iron being worked up into plates, railway tyres, and bar iron for rivets, chains, and general purposes. The main works, consisting of the forge, two blast-furnaces, and engineering shops, cover about 15 acres of land surrounded by the Low Moor Common. At a short distance lie the Bierley and New Biggin Works, where six blast-furnaces supply the forge with pig-iron, though only four of these are now in actual operation. These furnaces are supplied from collieries extending over an area of nearly 18 square miles, lying in the townships of North Bierley Tong, Bowling, Cleckheaton, and Clifton, and connected by tramways with the various works. There are also ironstone collieries in the townships of Churwell, Beeston, Osmandthorpe, and Potternewton, in the neighbourhood of Leeds, the output of which is conveyed by rail on to the sidings of the company. In the ironworks and collieries together there are employed not less than 4000 workmen.

During the last 15 years the capabilities of the production in the forge department at the Low Moor Ironworks has materially increased — there are now about forty puddling furnaces, twenty steam and other forge hammers, and eight rolling mills. Twelve years ago the demand for large boiler plates had increased to a considerable extent, and the Low Moor Company were compelled at that time to put down a 24-inch plate mill, the size of the only one they previously had (and which is still working) being only 18½ inches. But the demand for still larger plates has kept steadily increasing, there being a growing desire with engineers and others to have boilers made of fewer plates, and consequently with a less number of riveted joints. This demand has naturally necessitated larger plate mills and more powerful machinery, and to meet this the Low Moor Company have had to put down another plate mill of such dimensions as enables them to meet the most extreme requirements of the market. This plate mill being one of the largest and most powerful in the country merits special attention.

The building in which the engines are placed is 70 feet long, by 30 feet wide. The interior walls are lined with white glazed bricks, ornamented at the bottom to a height of 5 feet with Minton tiles, and the ceiling is constructed of polished pine, thus giving to the building a clean and neat appearance. A powerful travelling crane runs the whole length of the building, being supported on ornamental cast-iron brackets.

The engines are a pair of high-pressure horizontal reversing, having cylinders of 50 inches diameter and a 5-feet stroke, arranged to work at 50 revolutions per minute, with an initial steam-pressure of 60lb. per square inch. The bedplates are of the Channel Section, 3 feet deep, made in two divisions longitudinally; the first and second motion shaft bearings form part of the bedplate, these parts being made considerably stronger. A transverse bedplate, also made in two divisions of the same depth as the former, is placed underneath, and in such a manner as to entirely support that portion of the top bedplate which carries the crank and second motion shaft. The right-hand division has an abutment, central with the mill shaft for tying in with the mill bedplate. The cylinders and covers are jacketed, having a 2 inches steam-space all round, the flange of the front end of the liner being connected with front cover and flange of jacket in the ordinary way. The steam ports are so arranged that the cylinders are completely drained of water, which passes off through the exhaust pipes, suitable arrangements being also made for carrying off the waste water from the jackets and covers. The valves are of the piston type, having loose linings 20 inches diameter, the steam inlet being in the centre, and the exhaust at each end of the steam chest; both lines of pipes are placed underneath the floor. The piston rods are 7 inches diameter, that portion carrying the outside bearing being 5 inches diameter. The smallest and largest diameters of the connecting rods are 6½ and 8 inches respectively, by 12 feet 6 inches long. The crank discs are of cast-iron 7 feet 2 inches diameter, 14 inches wide, and cored out in the usual way, so as to balance as much as possible the reciprocating parts of the engines.

The bearings of the crank-shaft on which is keyed the pinion, are 18 inches diameter, 2 feet 3 inches long, while those of the second-motion shaft are 21 inches diameter, 2 feet 3 inches long. Both these shafts are made of Low Moor wrought iron, the weight of forgings for which were 6 tons and 12 tons each. The pinion, which is cast in one piece is 5 feet 5¼ inches diameter, while the central part of spur wheel is composed of one casting, and the rim is made of eight spur segments dovetailed and keyed on, the diameter being 13 feet 7¼ inches; the teeth are 8 inches pitch, 2 feet wide on the face, both wheels being shrouded to pitch line. The driving-shaft is connected with the coupling spindle by a fast-and-loose crab or clutch in the usual way. The valves are worked by Allen's straight-link motion. The engines are reversed by a steam cylinder and oil cataract, the levers for working this, and also the regulating valve, are placed outside the engine-house, in such a position that the man in charge has a full view of the mill when in operation. The engines are supplied with steam from four boilers, any surplus steam from which, when the engines are not working, is passed through reducing valves into pipes attached to low-pressure condensing engines; thus utilising any spare steam which occasionally might otherwise be wasted.

In the plate-mill, for the working of which these engines have been erected, the foundation and bedplates are very massive. Openings in the stonework are made for the levers and balance weights, and a passage runs longitudinally on each side of foundation for repairs, and also for adjusting the machinery below when changing the rolls. The bedplate on which the pinion and roll-housings stand is made in three pieces, which are dovetailed and keyed into each other. The one nearest the engines is keyed, and also fastened with wrought-iron tension hoops, on the engine transverse bedplate, and the whole is firmly bolted down to the stone foundation. The coupling bar between engines and pinions is of wrought iron, 18 inches diameter, supported in the centre by a pair of friction rollers. The pinions are on the cross-tooth principle, 2 feet 10 inches diameter, and 8 inches pitch. The roll housings are especially strong, each weighing upwards of 17 tons, and having a wrought-iron screw 10 inches diameter and 1 inch pitch, worked by a circular spanner in the ordinary way for regulating the rolls. The plate-rolls are 11 feet long and 32 inches diameter, cast solid, so that the mill is capable of rolling plates upwards of 10 feet wide.

For the assistance of the workmen when rolling a plate, friction rollers, extending nearly the whole length of the rolls, are fixed, front and back. The top of these are placed a little higher than the surface of the fore plates, and are worked by levers placed on each side of the mill, by moving which a small wheel, working on an eccentric shaft is forced into contact with a larger wheel keyed on the end of the bottom roll, and at the same time with another small wheel attached to a shaft, which passes through the housing, and thereby starting the friction roller which carries the slab or plate towards the rolls. In addition to this, a feeding-gear is placed on each side. These consist each of a series of forks, fixed on a rocking shaft, which works in an oblique direction, and by using a lever placed outside the roll standards, it is so arranged that when applied, these forks are lifted obliquely against the slab, or plate, and push it forwards into the rolls. These appliances (the design of which is not altogether new) have proved of great service during the rolling of large plates. This mill is placed in a line with, and under the same roof as, the 24-inch plate mill, the plate shears being equidistant, so that one cooling and straightening floor and one pair of plate shears serve for both mills. Two powerful travelling cranes run the whole length of the building, for changing rolls and for repairs. The Low Moor Company have so far only put down one pair of grain rolls, but the foundation bedplate and all other necessary preparations are made with a view to putting down chilled rolls, should they be required.

In conclusion, we may mention that the engines were made by Messrs. Kitson and Co., of Leeds, the spur gearing and plate mill throughout were made and carried out by the Low Moor Company, from the designs and under the superintendence of Mr. Henry B. Woodcock, the Company's Forge Manager.

THE RADIATION OF THE SOLAR ATMOSPHERE.—Prof. T. P. Langley brought before the National Academy of Sciences of the United States, at its half-yearly meeting, a statement of his researches on the radiation of the solar atmosphere. Padre Secchi stated that the heat of the northern hemisphere of the sun was to that of the southern as 100 to 75. This result was verified by MM. Cruls and Lacaille. Prof. Langley has carefully repeated his experiments, and after 400 observations he is satisfied that there is not a demonstrable difference in the heat of the two hemispheres.

ROAD LOCOMOTIVE ENGINE.

BY MESSRS. AVELING AND PORTER, ROCHESTER.

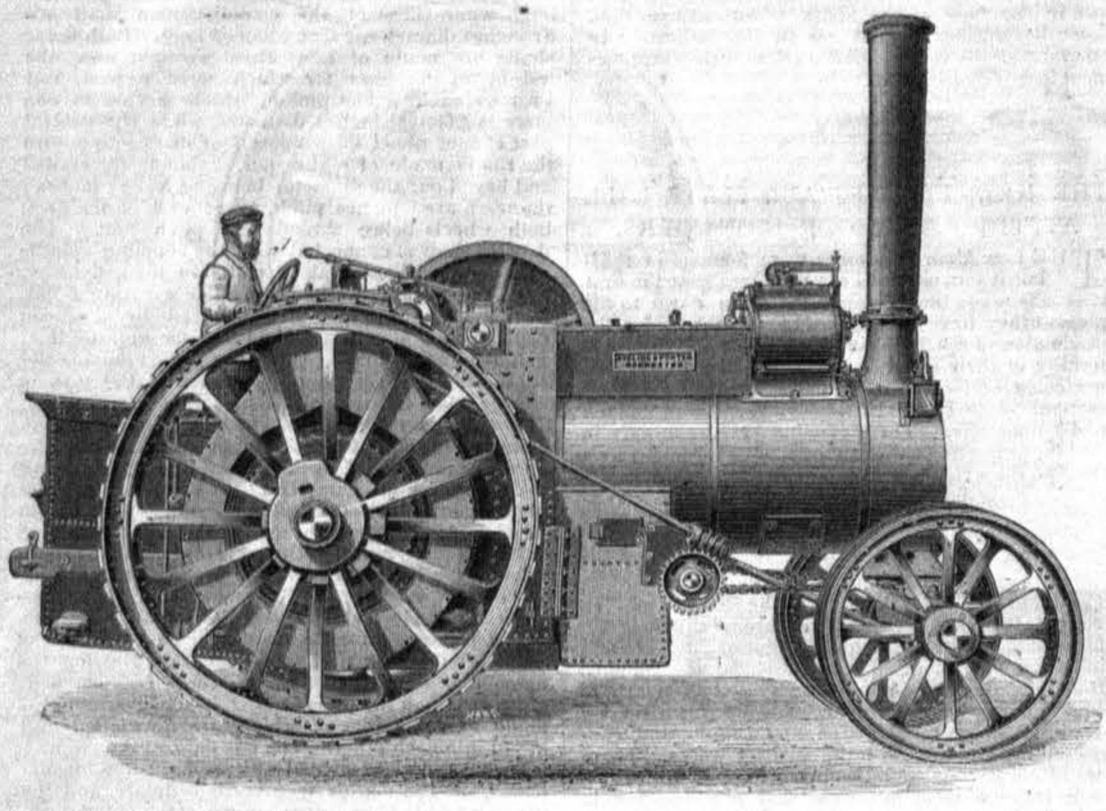


FIG. 1.

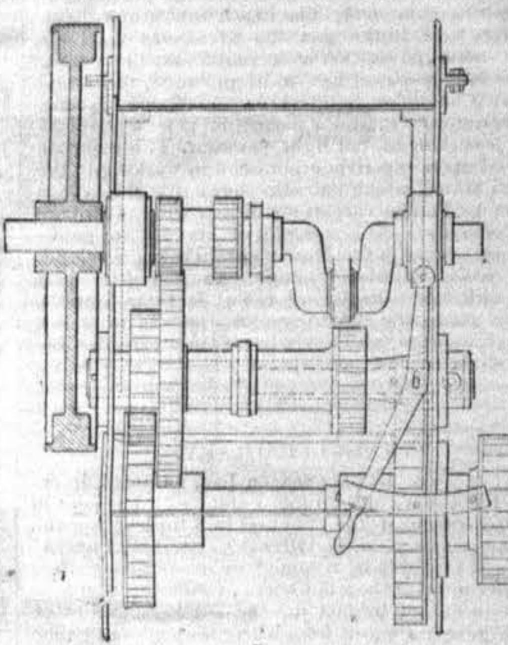


FIG. 3.

THE accompanying illustrations represent the latest development in steam engineering practice as applied to road locomotives by Messrs. Aveling and Porter, of Rochester, a firm whose name has long been identified with this class of machinery. Fig. 1 is a perspective elevation of the engine in running order; fig. 2 a transverse section; whilst fig. 3 is a plan showing the arrangement of the steel crank and countershaft gearing, designed and introduced by the makers of this engine. It will be seen that the cylinder, which is steam-jacketed, is placed on the forward part of the boiler. The crank-shaft brackets are formed out of the side plates of the firebox extended upwards and backwards, carrying the crank shaft, counter shaft, and driving axle bearings, in one plate. Leakage from bolts and other objectionable features are thus avoided. The driving wheels, which are constructed in accordance with the requirements of the new Act of Parliament, are 7 feet in diameter and 16 inches in width, and are constructed of wrought T-iron of a new and specially-strong section, with steel diagonal plates. When engines are required to work over paved roads, the driving wheels are fitted with Adams' patent spring tires. A winding drum, capable of holding 100 yards of ¾-inch steel wire rope, can be fitted to the driving axle when necessary. The tender and water tanks are constructed to carry an extra supply of water. An injector, water elevator, with 26 feet of suction hose, lamps, and other necessary tools, are supplied with each engine. The compensating gear wheels are of large diameter, and are made from the best crucible cast steel. The boiler is made of the best best quality of Yorkshire iron, double riveted, and capable of working at a pressure of 150 lb. per square inch. The firebox is of Low Moor iron, and is fitted with stays, placed 4 inches apart. From an inspection of the transverse section (fig. 2) and the part plan (fig. 3) of this engine, it will be seen that the whole of the crank-shaft and counter-shaft gearing is arranged to work between the wrought-iron brackets instead of outside, and that the fly-wheel is fixed close to the crank-shaft bearings. The gearing is all of the best crucible cast steel, and the pinions for the two speeds are keyed fast upon the crank shaft, instead of sliding on feathers, which are a frequent source of trouble, on account of their working loose. The arrangement for altering the speed is clearly seen in fig. 3. The intermediate shaft is fixed, and serves as a stay to the side plates, and the sliding sleeve which carries the spur wheel and the fast and low speed pinions, revolves on it. The two crank-shaft pinions are of the same size, and the intermediate spur wheel gears with either one or the other, as required. When the parts are in the position shown in the plan, the engine is in its fast speed; but if the sleeve be moved to the right, the other crank-shaft pinion comes into gear; also the right-hand sleeve pinion gears into the right-hand spur wheel upon the counter-shaft, and the engine is in slow speed. The gear and shafting are of very strong proportions, and the wearing surfaces are ample. This arrangement materially reduces the width of the engine, and brings the driving wheels much closer to the axle bearings, rendering the engine particularly useful in cases where narrow roads abound.

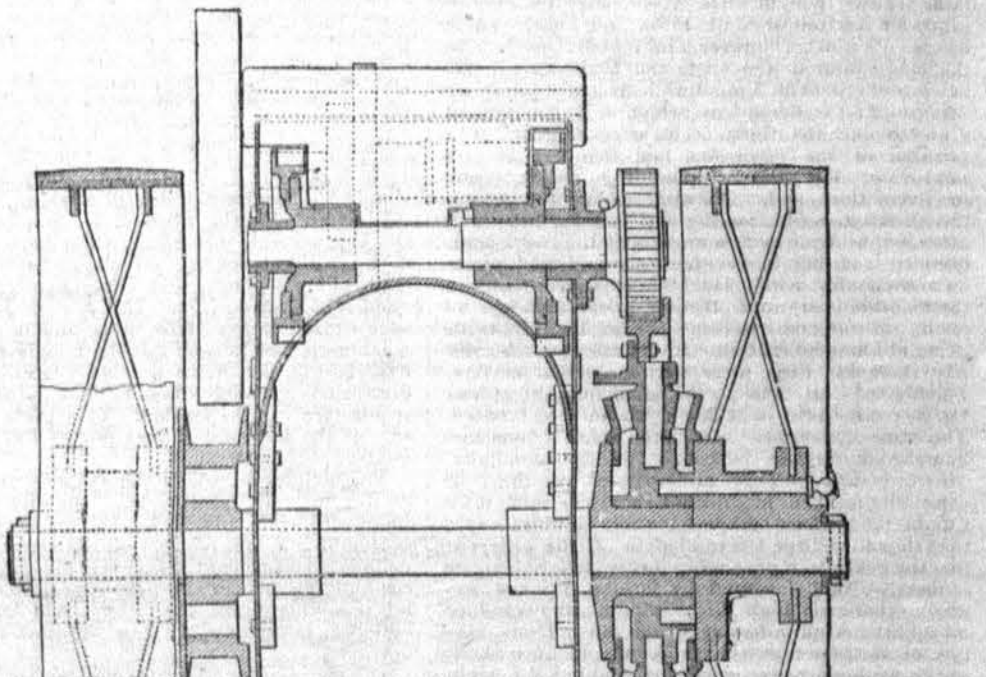
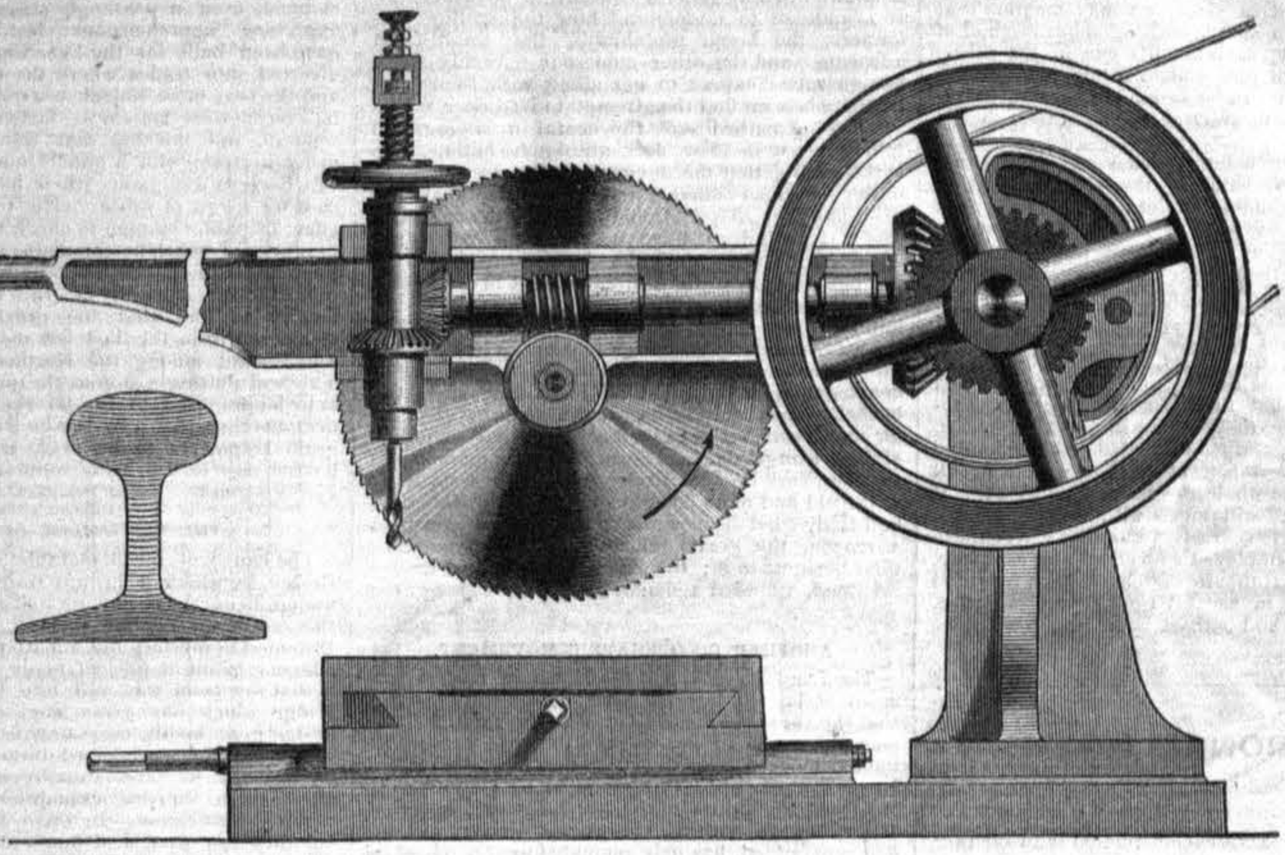


FIG. 2.

THE NEW EDDYSTONE LIGHTHOUSE.—The work on the new lighthouse at the Eddystone has been suspended and the *Hercules*, the steamship used as a tender of the engineer, is laid up in dock. The circular area on the south reef is enclosed by a massive dam, as the site of the new tower is now almost covered by stonework in position, and within six months it is hoped that the basement of the building will be above high-water level. It will form a compact mass of granite masonry, formed of stones three tons each in weight. The surfaces of the stones are very curiously interlaced. It is considered that in preparing the foundation, most of which is some feet under water, and bringing the stonework to its present height, the engineers have completed the most difficult portion of the undertaking, and, all being well, the whole will be finished within two years. The new light will be visible from Plymouth. Although every atom of material used has to be conveyed in the *Hercules* from Plymouth, not a stone has been lost, and, notwithstanding the fact that the works are exposed to the full force of the Atlantic, there has been no accident to life or limb.

CIRCULAR COLD SAWING MACHINE.

BY MESSRS. SELIG, SONNENTHAL AND CO., LONDON.



CIRCULAR COLD SAW.

THE advantage of working metals cold as compared with manipulating them hot, are too obvious and too well known to require enumeration here. We may, however, observe that even when cutting square and round bars of from 2 to 3 inches, the saving both in time and expense is very considerable. These bars can be cut in the time it would take to only heat them. Two men are necessary to cut bars with a chisel when hot, while one man can easily cut them with a saw when cold in less time, to say nothing of the coal used for heating. A cold saw cut leaves the iron in a perfectly finished condition, requiring no such work as filing the end true and level. It is, therefore, with satisfaction that we note a new circular sawing machine for cutting iron or steel rails, joists, and the like, cold, and which is being introduced by Messrs. Selig, Sonnenthal and Co., of Lambeth Hill, Queen Victoria Street, London. This machine, as arranged for steam power, is illustrated in the accompanying engraving, from which it will be seen to possess several advantages over the ordinary machines employed for this purpose. In the first place there is an independent table under the saw, the construction of which offers special facilities for fixing the material to be cut in any position, and all bevels and skews can therefore be cut with this saw. In the next place, this saw works quicker than any other, because the amount of feed is not regulated by mechanical means, and is constantly equal, but it adjusts itself automatically to the amount of cut by means of a weighted lever, feeding the saw quicker to its work where the section is small, and reducing the amount of feed in larger sections. The saw thus removes an equal amount of metal in a given time, as indicated by various widths between the lines in the rail section shown in the engraving. The oscillating lever carrying the saw can be fixed at different angles and heights, and this feature, combined with the others, renders the machine a very desirable acquisition where the work for which it is intended has to be performed. The machine is fitted up so that the saw revolves in the direction of the arrow at a speed of about eight revolutions per minute.

LIGHTING RAILWAY CARRIAGES.

BUT few, if any, of our readers will differ from us in pronouncing the general system of railway carriage lighting to be extremely bad, and in some cases simply execrable. It is true that the metropolitan lines, with their portable gas-lighting, afford an exception to the general rule, but this system has the objection of requiring the reservoirs to be frequently filled during the day, so that the arrangement is inapplicable to long-journey and express trains. On the Great Eastern, and partially on the Metropolitan railways, some of the carriages are lighted with oil-gas used under pressure. But we are not aware that the system has as yet, been introduced in long-journey trains. The Great Northern Company, however, are now trying a system of lighting with an enriched gas, which promises well for use in trains running long-distances, and in any extremes of temperature. In order to render clear the special features of this new gas, we may premise that ordinary coal-gas consists of 94 per cent. of hydrogen and marsh gas, and 6 per cent. of hydro-carbon gases. The light is mainly obtained from these latter gases, the properties of the hydrogen and marsh gases being rather heat-producing than light-giving. One of the richest of the hydro-carbon gases is naphthaline, which, however, solidifies at low temperatures, and becomes deposited in the form of crystals, the gas being thus deprived of the benefit of its presence as an illuminant. It is found, however, that by the addition of certain other hydrocarbons the crystallisation of this naphthaline is prevented, and it is retained in the body of the gas in a gaseous form. It thus remains available for use, and in combination with the additional hydro-carbon gases, raises the illuminating power of ordinary 16-candle coal-gas to about 40 candles.

We have recently been afforded the opportunity of inspecting the arrangements for producing this result, the system being the patented invention of Mr. William Sugg, of Westminster, jointly with Mr. F. W. Clark. The hydro-carbons, which are added to the ordinary coal-gas, are obtained either from naphtha or light petroleum oils. The hydrogen and marsh gases, having a great affinity for them, absorb a certain definite quantity of these rich illuminants, which they retain after being subjected in combination to a temperature of about 700 degrees Fahr. The ordinary gas, thus highly enriched, is pumped from this mixing apparatus to a reservoir, where it is stored for use under a pressure of about 120 lb. per square inch. The introduction of this invention on the Great Northern Railway is due to Mr. T. C. Hersey, the chief inspector of the Gaslight and Coke Company, the experiments being carried out at the company's expense. They have a gas station, which adjoins the Great Northern Railway at King's Cross, and there the enriching apparatus is in operation, being in charge of Mr. John Clark.

Upon Mr. Hersey introducing the matter to Mr. Oakley, the superintendant of the railway, he gave permission for a first-class carriage to be fitted with proper lamps and apparatus, which were designed and applied by Mr. Sugg. On the top of the carriage are four cylindrical iron reserviors, each being 15 feet long and 8 inches in diameter, and in these the gas is stored, under a pressure of about 60 lb. per square inch. Small pipes convey the gas from these reservoirs to the lamps, which are placed in the roof of each compartment, and supplied with the requisite arrangements for controlling and economising the supply of gas. The lamp frames are made of nickel silver, and have a very handsome appearance. The rim around the glass is perforated, and serves as a ventilator, the vitiated air being carried out by way of the roof by the aid of an induced current, produced by the lamp flame. The gas is conducted from the works to the platform through an underground pipe, the supply to the carriage reservoirs being effected through a flexible hose. The durability of the small bulk of gas carried is such that the carriage has made the journey to Leeds and back with one charge the four lamps being kept burning all the time. This journey has been performed several times with the same results, even during the severe weather last month, when several inches of snow on the roof failed to affect the gas in the least. Gas, in fact, has been left in the reservoirs, and exposed to the cold for a week without any condensation taking place, or its value as an illuminator being impaired. The success of these trials has led Mr. Oakley to give permission for another carriage to be fitted up, and which is intended for service between London and Aberdeen, which distance it is to run with one charge of gas. The success of this experiment may lead to the general adoption of the system on the Great Northern Railway. Should this be so, we hope other companies will follow the example, and change their old lamps for new ones. They have only to take ordinary gas from any convenient points on their lines where it is supplied, enrich it, and supply it to their carriages, for which they will have the thanks of the travelling public.

METAL DECORATIVE TILES.

AMONGST the numerous modern applications of iron and steel that relating to the manufacture of wall decorations for superseding the ordinary decorative tiles is certainly one of the most recent and interesting. The adaptation of metal to this purpose supplies a want which has long been experienced in architectural and building work, namely, an inexpensive substitute for the costly Minton encaustic tiles. Up to the present time nothing, so far as we have seen, has been produced which is equal in effect to earthenware tile decoration for certain purposes. An examination of the metallic wall decorations which are termed "metal decorative tiles," however, convinces us that their inventor, Mr. Henry Rees, has devised a substitute for the ordinary tiles, which is not only quite equal to them in appearance, but which possesses many advantages, including that of lesser cost, which render them superior to the ordinary decorative tiles. With regard to their manufacture, we may mention, in the first place, that the so-called metal tiles are made from soft iron or steel rolled into thin sheets of 26 or 30 gauge, which renders them perfectly flexible. Both sides are well tinned and afterwards varnished or japanned by a special process; this insures complete protection to the metal from the action of damp. The next process is the enamelling of the surface and printing the pattern, and finally comes the glazing. The plate thus prepared is then subjected to a very high temperature, but the tile is not vitrified, as is the case in the manufacture of earthenware; the result is that these metallic tiles are not only flexible but will not fly under heat, and will stand any amount of knocking, even with a hammer, without being defaced. The advantages thus obtained over earthenware are very obvious. With respect to fixing them together and in place, we may mention that this is effected by a simple and ingenious method of flanging two sides, each tile fits one in the other, covering the small pins which secure them to the wall. In fact, they can be fastened in several ways, to suit the material to which it is desired they should be attached.

From a sanitary point of view we cannot too highly estimate the value of these metallic tiles; besides being exceedingly light, yet strong, and readily secured to any wall or ceiling, they can be washed as easily as glass, and will not retain infection. Hence their especial value for hospitals, ships' cabins, and the like, and, indeed, for all kinds of building decorative purposes. Messrs. James H. Weager and Co., of 26, Leadenhall Street, are the London agents for these tiles, and they inform us that forty houses at Sutton are now being fitted with them, and that the effect is most successful. Not only are they a protection to lavatories, bath rooms, halls, and so on, but they considerably enhance the appearance of a house at a small extra cost. On the whole, we should say that this is an enterprise that will meet with large success, inasmuch as there is scarcely a building where these tiles could not be employed with effect and economy. We understand that this invention has been patented in Great Britain, in several Continental countries, and in America; and both at home and abroad we wish it success.

OCCASIONAL NOTES.

THE DESTRUCTION OF TIMBER IN AMERICA.

At last the United States Government is awakening to the importance of preventing that wholesale destruction of timber which was threatening scarcity even in the primeval forests of the West. The law, as it at present stands, apparently allows a too free use of the timber which, in the Western, or at least the Pacific States, is chiefly found on the unappropriated tracts. The consequence has been that many more trees have been felled than were actually required, and that no provision has been made of replanting or reproduction. It is now recommended by the Secretary of State for the Interior, in his annual report, that the Government be authorised only to sell timber from the lands referred to, retaining the fee, and that the sales be conducted under such conditions as will prevent denudation. This, in connection with penalties for the wilful and negligent destruction by fire of wooded tracts in the hands of Government, both of which measures have been successfully carried out in our Indian possessions, will, Secretary Schurz considers, place a strong, if not wholly effective, check on the destruction now going on, and which, if not stopped in time, will doubtless result in serious evils, climatic and economical.

SHODDY.

There are incidental advantages to be obtained from the introduction of the fibres unravelled from old woollen cloth into new, which, probably as much as the cheapening of the raw material, have tended to give endurance to the manufacture of shoddy and mungo. Saving that it enables disingenuous tradesmen to take advantage of their customers, there is not so much to be said against that branch of English manufacture which makes inexpressibles possible at from four to thirteen-and-six. At all events, the production of shoddy and mungo, which is effected by a formidable machine, all teeth and claws, and named the "devil," holds its ground pretty well amidst all the depression, as is shown in the following abstract from the recent official returns of the worsted and shoddy industries of the United Kingdom. There are, it appears, 137 shoddy factories in England, Scotland and Wales. There are no shoddy factories in Ireland. In England the number is 134, and in Scotland only 3. The number of spinning-spindles is 83,702. In 1870 the number was 133,211. The number of doubling-spindles is 9282, which is a remarkable increase as compared with the number in use in 1870, the number at that date being 582. Power-looms are in decidedly less request now than they were nine years ago, as witness the respective totals of 2690 and 2110. The number of work-people employed in shoddy factories has risen from 3816 to 5079, about 4000 more females being now employed than was the case in 1870. It will be seen from this *resumé* that there are no shoddy factories in Ireland, owing, perhaps, to the more thorough manner in which the natives there wear their clothes out; and very few in Scotland, where, as with the Americans in the cotton trade, it may have been found that honesty is in the end the most profitable, Scotch tweeds from their acknowledged genuineness invariably topping the market and finding a ready sale.

OBSTACLES TO CHANGE.

Nobody who has not tried to overcome it, can estimate the force of that *vis inertia* of Conservative habit and that obstruction from the established order of things which stand in the way even of changes acknowledged by general consent to be beneficial. It is difficult to understand how the spelling reformers, the liquor prohibitors, the small farm advocates, and the other numerous "friends of the human race" expect to get along with their nostrums when we find the attempt to introduce such a small thing as the use of the cental in buying and selling grain in New York absolutely failing, notwithstanding that the decimal system is employed in the American coinage, and that the cental system itself has been adopted from the first by the railways, whose rates, indeed, have never been fixed by the bushel, so that the grain dealers have always had to use the cental system to a great extent in connection with the carriage of their grain. The American mind has never been considered unduly wedded to the past, and there were other reasons for hoping that the change referred to would be taken as a thing of course, such as the practical inconvenience of the bushel system, and the use of the cental system for for some years back at Liverpool, the great emporium of American produce. Nevertheless the members of the New York Produce Exchange recently went back to the old and more complicated method before they had fairly tried the new and simpler one, alleging, as a reason, the great difficulty of accommodating their business to it; the same result which, we are informed, attended a similar attempt in Chicago ten years ago.

ANOTHER CO-OPERATIVE MOVEMENT.

The London public and the Northern coalmasters seem at last to have become conscious of the fact that the supply of domestic coal to the metropolis is manipulated by a "ring;" and the best excuse for the existence of the association that has been formed for the purpose of breaking it is to be found in the fact that the prices of the best Silkstone, delivered at St. Pancras, with the charge for delivery in London superadded, has only amounted to 17s. 9d. while the Coal Exchange quotations have been 23s., a profit of 5s. 3d. per ton. The Northern coalmasters are not the only producers who, with their ultimate customers, have been thus skinned by middlemen and retailers. Some time ago certain Northern graziers made arrangements for dealing directly with the butchers; and the American exporters would find it to their advantage, certainly much to the public advantage, if they retailed their own goods instead of disposing of them to the butchers. The London public are as much imposed upon in their greengroceries as in anything. It would make some good housewives open their eyes very wide if they were told the present cost of the potatoes for which they have paid, say, 2d. a pound. The way in which the market salesman, the intermediary between the producer and retailer, takes his toll is very well illustrated by the story of a market gardener who saw a fine sample of white turnips sold at from £4 10s. to £4 5s. a ton, for a similar lot to which a salesman had returned 50s. per ton, less carriage and commission. Nor is the retailer a whit behind the salesman. Another newspaper correspondent states that some six months ago he saw a quantity of asparagus in Covent Garden Market sold at 1s. a hundred. He followed the buyer to his shop, and inquiring the price of the bundles just brought from auction, was told that it was 2s. 6d. a bundle, a profit of 150 per cent.

ARTIFICIAL DIAMONDS.

It has long been known that the diamond is simply crystallised carbon, and the composition of the other precious stones has also been ascertained by the mineralogist. The announcement by Mr. Mactear, of the St. Rollox Works, Glasgow, that he had succeeded in crystallising carbon, and had made, or all but made, real diamonds, received therefore, conditional credit; and there was thus held up before our eyes the prospect of something like a verification of the alchemists' dreams—diamonds, rubies and other gems, rich, but no longer rare, manufactured out of brick-dust, coke and other elements equally vile! And in the event of Mr. Lockyer's spectroscopic suggestions being realised, their golden settings were also not impossible. All this bright vision has been dashed by Mr. Nevil Maskelyne, who, after subjecting to various crucial tests Mr. Mactear's diamonds, pronounces them to consist of "some crystallised silicate," and consequently not diamonds at all, any more than the "paste," by which the Parisian craftsmen contrive to imitate so closely the most precious of all precious stones.

LOSS OF LIFE AT SEA.

A Gravesend clergyman has addressed a most significant letter to *The Times* on the loss of life at sea. He shows that during the last five years the sacrifice of life in "missing" British ships has been especially great—6094 lives, as against 5954 in vessels which were wrecked and their fate known. This points to foundering at sea, occasioned by increasing stowage at the expense of safety, by experiments in new-fashioned rigging in sailing vessels, and by unnecessary efforts after exceptional speed. Another potent and frequent cause of foundering is the shipping of grain in bulk, and another in coal cargoes insufficiently ventilated. We have had occasion also too frequently to notice the careless way in which gunpowder and other explosives are shipped, even in passenger steamers. Mr. Scarth expresses apprehensions lest steamers which have been built for the Suez Canal trade should be diverted into trades where the cargoes are heavier and the seas more violent; when saloons will be turned into receptacles for cargo, instead of places for passengers, and the ship that would have weathered many a storm with a goodly number of passengers will become dangerous when heavily laden with a shifting cargo of grain. He trusts much to the effect of public opinion to check the increasing malpractices of which he complains; but there is a part likewise for the public authorities to perform. With regard to the shipping of grain in bulk, it is satisfactory to find that the great loss of Atlantic steamers within the last few months has prompted a movement among the Northern shipowners with a view of putting a stop to the practice; and that it is to be proposed to the Marine Association, at its next meeting, that a by-law be passed to compel all grain shipments to be made in bags, the shifting boards now in use being quite insufficient to keep cargoes steady.

THE TAY BRIDGE DISASTER.

The cause of the deplorable disaster to the Tay Bridge, by which a railway train and its freight of human beings were precipitated into the river during the storm on Sunday evening last, still remains shrouded in mystery and a matter of pure conjecture. The only point at present made clear by the divers is that the train was well into that portion of the bridge which has given way, and that train and bridge went bodily over together. Various hypotheses have been advanced during the past few days to account for the catastrophe, but each and all of them suppose a condition of matters which requires verification. In order to substantiate any one theory, a great deal more requires to be known than at present appears. There were undoubtedly several agencies at work tending to conduce to such a disaster, and their combination has as undoubtedly effected it. It is impossible not to believe that those who had charge of the designing and constructing of the bridge did their best to ensure its safety. They doubtless took into consideration all the contingencies that were ever likely to affect its strength and stability; and they no doubt prepared their designs accordingly, and in accordance with the best principles of modern engineering construction. But, unfortunately, underlying all this was the implied, if not expressed, injunction to keep down the cost as much as possible, an injunction which many an engineer of the present day has had to wrestle with. It is possible—nay, we fear it is probable—that in making the Tay Bridge an example of cheapness those in charge were unwittingly led to leave a smaller margin for contingencies than was consistent with prudence.

SCIENCE AND ART.

Discovery of Antique Goldsmiths' Work.—The *Figaro* contains a letter from M. Boyer de Ste. Sazanne, stating that during the excavations for a gas-holder at Monaco, a valuable treasure of antique goldsmiths' work has been found. The relics consist of three large golden bracelets of the form called *porte-bonheur;* three golden bracelets, engraved with figures in relief, two more bracelets of gold, a bracelet of an oval form (*à charnières d'or*), a diadem of gold, *estampé*, with figures in relief, an inedited medal of Gallienus, eight very rare Roman medals of gold, a bust of Gallienus in gold *repoussé*, five centimètres high. The writer believes that all these objects are Roman, of the third century, and that they were probably the decoration and honorary distinctions of a Tribune of a Legion of the time of Probus.

Natural Electro-plating.—Some specimens collected in South America by M. Fremier, who was for some time director of the silver mines at Caracoles, have been examined in Paris by M. Jannettaz, who has discovered among them an extraordinary example of an ammonite transformed into native silver. It was found with a number of other ammonites belong to the two species *A. peramatus* and *A. plicatilis*, but these had not been mineralised with silver-salts. The ammonite in question has, on the other hand, been entirely replaced by chloride of silver, which has been partially reduced to the metallic condition. Light is thrown by this specimen upon the origin of the native silver which occurs in the Caracoles mines; for it is only fair to infer that this metal has, in like manner, been reduced from the state of chloride at a period not earlier than the deposition of our Oxford clay. The description of the ammonite in silver will be found in the current number of the *Bulletin* of the Geological Society of France.

Intensities of Different Coloured Lights.—A means of comparing the intensities of lights of different colours has long been desired. Until quite lately, there did not even exist a means of measuring the relative intensity of two lights of the same given colour. M. Gouy has been investigating the latter point by the aid of a particular photometer, and by flames of constant brilliancy, produced by the combustion of a homogeneous mixture of coal-gas with air impregnated with saline powder. The photometer resembles in general appearance a two-prism spectroscope, having also an auxiliary collimator with a fixed lamp to serve as a standard light. In place of the usual eye-piece of the instrument, a second slit is placed. By this means any one ray can be separately observed, and its intensity compared with the intensity of the same ray from the standard source. M. Gouy states that this slit eye-piece arrangement is capable of such accurate adjustment that each of the two O-lines can be separately examined and its intensity measured.

The Action of Safety Valves.—Some useful observations on the actions of safety valves on boilers have been recently communicated to the Vienna Academy by Herr von Burg (November 13). Among other things it is proved that the authoritative directions given in different countries as to the size of safety valves are not at all adequate, and are based on erroneous conceptions. As to the cause of the small amount of lifting of the valve during escape of steam (seldom over ½ mm.), the author at first supposed a vibratory motion of the valve, but further study and experiment led him to the hypothesis that the steam-jets, in lifting the valve, do not begin to move from its middle point, but from the periphery of a circle, p, out to the circumference of the valve of radius r; so that the pressure of steam on the under surface of the valve is composed of two parts, of which the inner, or *aërostatic*, is produced by the solid steam-cylinder of radius p, and the outer of weak *aërodynamic* part, by the external hollow cylinder of r-p thickness of wall. The phases of development of steam tension, and other topics, are also investigated.

The Goldsmiths' Company and Technical Education.—With a view to the encouragement of technical education in the design and execution of works of art in the precious metals, the Goldsmiths' Company resolved early in the present year to give the following annual prizes, viz.: £50 for the best design for some article in gold or silver, which, when manufactured, shall exceed 30 ounces in weight; £50 for the best model for some such article; £25 for the best execution and workmanship of some such article; three prizes of £25 each for (1st) the best design, (2nd) the best model, and (3rd) the best execution and workmanship of some article in gold or silver which, when manufactured, shall be less than 30 ounces in weight; and a prize of £25 each for the best specimens of chasing, repoussé work, and engraving. The conditions were that originality should be necessary to obtain either of the prizes for design, and no copy should be the subject of a prize. No prize is awarded in respect of a design for an object of jewellery or a personal ornament, nor for the execution thereof. The prizes have just been awarded by the Company as follows: Mr. W. Herbert Singer, Frome, design for a clock, £50; Mr. Henry Harvey, 80A, Jubilee-place, King's-road, model for an altar dish, £50; Mr. Joseph Holgate, 19, Walton-street, Chelsea, design for a mirror frame, £25; Mr. W. Marshall, 4, Lamont-road, Chelsea, model for a card tray, £25; Mr. T. Edwards, jun., 74, Halton-road, Islington, silver tankard, for execution and workmanship, £25; Mr. A. W. Austin, 89, Winston-road, Stoke Newington, repoussé work, £25; Mr. Deere, 37, Cloudesley-road, Islington, chasing, £25; Mr. William Richard Corke, 61, St. Peter's-street, Islington, engraving, £25; Mr. Hugh Stannus, 118, Kennington Park-road, design for two tankards (an extra prize), £10; Mr. Christopher Smith, New Town Hall, Wakefield, model for a cup (an extra prize), £10.—*City Press.*

British Museum.—To the British Museum few visible additions have been made since the exhibition of the new gallery at the top of the grand staircase of the superb collection of antiquities and articles bequeathed by Mr. Henderson, except some further additions and those singularly truthful and elegant displays of British birds in the Zoological galleries, which have been so much admired. The institution is evidently rising in popular favour, as under the superiority of the existing management it might be well expected to do; for the more the public is considered the more regard the public may be expected to display in return. The present crowded state of the Museum collections is a barrier undoubtedly to the full value which might be made of its unrivalled stores, but from holiday time to holiday time—short as the periods are—some fresh attention is now invariably witnessed, some new thoughtfulness for the mass—and some further evidence of proper care and regard also for students and readers. The illumination of the hall and reading-room by the electric light had evident attractions in the latter part of the day for the crowds, of which there had been so great an influx in the afternoon. The galleries were all full after two p.m., and there were more than the usual numbers for even Boxing Day. Last year the full totals of admissions was 3345; sometime before closing on the 26th ult., the numbers had reached to 7013, and the full total will be, no doubt, some hundred or more at least beyond. Since the electric light was introduced into the reading-room three months ago, and the hour extended from four to seven p.m., there has been a great influx of readers, and on many days there have not been sufficient seats for their use. On Boxing Day 93 additional seats were formed by economising space, adding another row at each end, and putting an extra table, with three chairs to each of the tables formerly in existence. The original number of seats for readers was 302, and this was found amply sufficient until very recently; now the seats number 395, which includes several specially provided for ladies. For the further convenience of readers shelves have been placed at the ends of the several seats, on which will be placed the more recent books of reference, more especially concordances. The shelves were put up last week, and in the course of another week the books will be in their allotted places, and will be a great boon to practical readers.

Professor Tyndall's Christmas Lectures.—On Saturday afternoon last Professor Tyndall, D.C.L., F.R.S., delivered the first of his annual course of Christmas lectures to the young at the Royal Institution, Albemarle-street, Piccadilly. The seats of the theatre, both above and below, were crowded with little folks and their friends, who loudly applauded the simple, but beautiful experiments by which the teachings of science were illustrated. It was in 1827 that Faraday's first series of juvenile prelections on "Natural Knowledge" were given on the same spot, as the audience was reminded by the great chemist's successor, who was naturally disposed to trace to that modest beginning much of the interest now taken in the communication of elementary instruction in science to the young. As he was to address boys and girls, he had chosen the two old elements, "water and air," on which to speak to them in the simplest words. We might be said to eat water as well as drink it, since how largely it entered into our food was shown by the fact that of the 64 lb. of muscle in an ordinary man's body, all but about 15 lb. was water. If asked whence this water came, they would answer, rightly enough, from the clouds; but as to how it got lifted up there, that might be left to be answered afterwards. Meanwhile, they were aware that our Thames water was the rainfall from the Cotswold Hills, which as it swept through the valleys picked up many impurities. Even our spring water, in percolating through various strata, especially limestone, got mixed with much mineral matter. By boiling the water all away, this mineral deposit was left behind in the shape of the fur which lined our kettles. In the limestone caverns the water charged with the mineral left the latter behind in the form of stalactites, which after many ages got conglomerated into the sort of stone called stalagmite. They were composed of carbonic acid and lime, the compound being called carbonate of lime. That carbonic acid is heavier than air was shown experimentally, a glass globe filled with it outweighing an exactly similar globe filled with water. The carbonic acid was further shown visibly, under a strong light, pouring out like water from vessel to vessel. Carbonate of lime was then made, in the form of chalk, by passing carbonic acid through lime-water, which, though perfectly transparent before, became chalky the instant the gaseous acid was poured into it. The result was shown to be the same whether the acid was that produced in the laboratory, by pouring hydrochloric acid on chalk or marble, or by uncorking a bottle of champagne, or by a single expiration of breath from the human lungs. Coming to the difference between hard water and soft, Professor Tyndall remarked on the two forms in which carbonate of lime exists—namely, the simple carbonate and what is called the bi-carbonate. The latter is the form in which it is found in the natural Canterbury water, which is drawn from the chalk stratum, and is accordingly charged with the extraordinary amount of 20 grains of lime to the gallon. Hence it is so hard as to make it impossible, without a great waste of soap, to get a lather from it, the waste of soap being spent in neutralising the lime. But Dr. Clark, of Aberdeen, had discovered a process for softening the Canterbury water by the paradoxical method of adding more lime to it, and Mr. Homersham, the engineer, had reduced the theory to practice in the Canterbury Waterworks, an account of which was given. Professor Tyndall illustrated the principle experimentally by adding the colourless lime-water, such as is stored in Mr. Homersham's reservoir, to the no less translucent Canterbury water—a farthing, it was said, could be seen in it clearly at a depth of 60 feet—when, by chemical affinity, the newly-formed simple carbonate was precipitated at once, the powdered chalk looking exactly like flour. Meanwhile, as the Professor proved by the lather he made on washing his hands in it, the hard water had become soft. The subject of colour having been familiarly discussed, and illustrated by optical experiments, including the decomposition of white light by the prism into the primary coloured rays, it was shown that water is not colourless, as it seems, but is really of a delicate blue tint. A glass of water did not show this, but a horizontal tube, 15 feet long, having been half filled with pure water, light was passed through it, when a beautiful hemisphere of delicate blue was at once shown upon the screen with a hemisphere of white light above it. The last experiment shown was that of Felix Savart, for showing the water-bubble without soap, which Professor Tyndall styled "the water-umbrella." It was introduced in discussing the question of the tenacity of water, which Dr. Henry, of Washington, was stated to have estimated at some hundreds of pounds the square inch.

SANITARY ENGINEERING, GAS AND WATER.

Margate Water Works.—The Margate Town Council have entered into possession of the waterworks for that town, which they have purchased for £59,000.

The Sanitary Institute.—A prize of £200 has been offered by the Rev. E. Wyatt-Edgell through the Sanitary Institute of Great Britain, for the best essay that may be sent in by the 1st of August next, on "The cause of hereditary tendencies in health and disease." The subject is of first importance, in its bearings not only on personal, but on natural health, and the Council of the Institute expects to receive many valuable contributions in competition. It only regrets that the generous donor, who for a long time has filled the office of honorary treasurer of the Institute, is obliged to resign office, owing to impaired health, which demands for a time residence abroad. The chairman of Council of the Institute, Dr. Benjamin W. Richardson, F.R.S., and Dr. W. Farr, F.R.S., are appointed adjudicators of the prize.

Purchase of the Cardiff Water Works by the Corporation.—A Committee representing the Cardiff Corporation have effected the purchase of the Cardiff Water Works for £300,000. This amount is to be raised in sums of not less than £500 at 4 per cent., and repayable in five, seven, ten years, and upwards. The shareholders in the water works received from their directors 200 per cent. on their shares, and the directors are going to Parliament to ascertain what is to be done with the large surplus, there being a dispute among the shareholders as to how it shall be apportioned. One hundred thousand pounds capital of the shareholders remain on mortgage.

Mineral Oil Lamps.—A series of comparisons of the forms of mineral oil lamps has been published by the chemist to a petroleum association, which, in addition to a comparative table of the value as illuminating agents of different forms of lamps and oils, gives a tabular statement as to the cost of gas and two kinds of oils. It takes the "most favourable examples in the case of oils, and, whilst stating that "under favourable circumstances" gas, consumed at the rate of 5 cubic feet per hour, gives "a light of sixteen candles," it yet takes twelve candles as the average illuminating power of gas. Hence, the bias of the calculation is seen to be in favour of oils; but bearing this in mind the calculation is curious enough to warrant reprinting. The cost of "1000 candle-hours" from petroleum oil at 1s. per gallon, the lowest price given with one exception, is stated as 9¾d.; the cost of colza oil, at 3s. 6d. per gallon, is for "4000 candle-hours," 2s. 8d.; whilst the cost of gas, at 3s. 6d. per 1000 cubic feet, is for the same extent of light calculated at 1s. 5½d. If it be borne in mind that the most favourable type of oil in use has been chosen, and that 25 per cent. has been deducted from the effect of the most favourable type of the use of gas, a tolerably correct estimate of the comparative cost of these three illuminating agents will be gained, subject to the possibility of procuring the cheaper form of oil at the price named—that given for gas being above the average of most large towns.—*Pall Mall Gazette.*

Liverpool Water Scheme.—The proposal to abstract a large supply of water from the upper sources of the Severn and convey it to Liverpool, is exciting much interest. The plans are now deposited with the clerks of the peace and other authorities, and they give an idea of the magnitude of the work which it is proposed to carry out, in order to convey the head waters of one of the principal rivers in Great Britain to our largest seaport, to supply the increasing wants of a teeming population. Within a few miles of the head of the Montgomeryshire river, Vyrnwy, which is one of the two great heads of the Severn, the mountain stream, bright and clear, except for an occasional stain of peat, runs through a comparatively narrow and deep valley, the lower end of which it is proposed to block up by an artificial dam raised to the height of 79 feet above the level of the valley. This dam will arrest the accumulating waters until they reach the height named, and this will cause a lake to be formed covering a thousand acres, and capable of containing ten thousand million gallons of water. The water will be conveyed over valleys and through mountains by aqueducts, conduits, and tunnels, to Liverpool, by way of Oswestry, Runcorn, Chester, and intervening towns, which the Liverpool corporation propose to supply with water as well as Liverpool itself. It is calculated that at first the supply to be abstracted will be at the rate of 13,000,000 gallons a day; but as the population of the district increases, that supply will be gradually increased, in the course of thirty years, to 40,000,000 gallons a day. In the construction of the lake at the source of supply the village and church of Llanwddyn will be submerged, and, to meet that contingency, it is proposed to pull down the church and to re-erect it on a more elevated position on the bank overlooking the lake. All the streams running into the Vyrnwy at Llanwddyn will be absorbed in the lake, and the waters of the neighbouring small rivers Marchant and Afon Conwy will also be tapped and conveyed by conduits to the lake. The scheme is opposed, as already stated, and the grounds of opposition are various. The corporations and other public and private bodies along the course of the Severn from the point at which it receives the Vyrnwy, a few miles below Welshpool, down to the tidal waters at Gloucester, allege that it will interfere with their supply of water for domestic and other purposes, both in respect of quantity and quality, but especially the latter, inasmuch as the water proposed to be taken is of the purest, and is most important as counteracting the deleterious sewage which runs into the river in its course from Shrewsbury downwards. The commercial interests oppose the scheme strongly, as it will in their opinion materially affect the actual supply so much as to diminish it to an extent that will obstruct navigation. The Severn is navigable by Act of Parliament as far as Pool Quay, a short distance below Welshpool, where the first impassable weir is thrown across the river. The Vyrnwy falls into the Severn below Pool Quay. There are navigation weirs at Gloucester, Worcester, Tewkesbury, and Stourport, constructed for deepening the water in the river for navigation purposes, but these are all passable by boats. Practically the river is not used for navigation purposes above or even up to Shrewsbury. Then the fishing interests, represented by the Severn Fishery Board, oppose the scheme as interfering with the supply of pure water, obstructing the passage of salmon up the river, and preventing the fish seeking the best spawning places in the upper streams. There is a general question raised on this proposal by all the objectors—viz., the policy of permitting the diversion of the waters of one watershed to another—a subject dealt with in the last session of Parliament by the Rivers Conservancy Bill, which was carried through the House of Lords, but which there was not time to get through the Commons.

NAVAL ARCHITECTURE.

A New Bridge at Wapping.—The new bridge at Wapping, being the principal entrance to the London Docks, was opened on Saturday, having been previously tested by bearing a weight of 35 tons. It will enable traffic to reach certain wharves and docks direct, instead of being diverted by way of Ratcliff.

Signalling at Sea and on the Thames.—A new system of international ocean and river signalling, with "rules of the road" at sea, is to be adopted in the forthcoming year. These rules have been promulgated by an Order in Council, given as the result of correspondence with every maritime nation in both hemispheres. The Governments acquiescing in the new regulations are—France, Germany, Russia, Italy, Spain, Portugal, Belgium, Denmark, Sweden, the Netherlands, Austro-Hungary, Greece, Chili, and the United States of America. Besides exhibiting the usual coloured lights, a steamer discerning another vessel in sight has to sound with the steam-whistle or fog-horn a short blast, which will mean "I am directing my course to starboard;" two short blasts will signify "I am directing my course to port," and three short blasts "I am going full speed astern." In fog, mist, or falling snow the signals are to be repeated every two minutes, a prolonged blast indicating that the vessel is under weigh, an ordinary blast that the vessel from which it proceeds is on the starboard tack; two blasts in succession, "I am on the port tack;" and three blasts in succession, "The wind abaft the beam." A vessel in fog, not under weigh, has to ring the bell every two minutes. Concurrent with the foregoing new ocean signals the Thames Conservancy are issuing rules which are to take effect on British and foreign ships entering the River Thames. When steamers are proceeding, one up and one down the river, involving a risk of collision, they will both keep their course and pass, either starboard side to starboard side, or port side to port side. In rounding a point, like that where the *Princess Alice* collision occurred, the steamer going against the tide is to wait under the point until the vessel going with the tide has passed clear. Where a steamer and a sailing vessel are proceeding in a direction likely to involve a collision, the steamer has to slacken speed and keep out of the way of the sailing vessel, and let the latter pursue her course. If the steamer cannot possibly or safely get out of the way, she is to blow four blasts and slacken speed, and the sailing vessel is to keep out of the steamer's way. A further improvement has been effected by the Board of Trade authorising some new urgent signals on the Thames. A British or foreign vessel signalling "Want Board of Trade officer," may hoist the ensign (of whatever nationality) at the main. "Want Police" is signalled by the flag commonly known as "Blue Peter" (letter P of the international code) being hoisted at the main, the calls to be kept up till answered.

MANGANESE BRONZE TORPEDO BOATS.—Mr. P. M. Parsons writes to *The Times* with reference to the manganese bronze torpedo boat recently arrived at Portsmouth from the Thames, Mr. Parsons says that the thickness of the plates forming the skin of this boat was not 3-16 inch, but varied from No. 9 to No. 18 wire gauge, or from little more than $\frac{1}{8}$ inch to about 1-16 inch. As regards the quivering spoken of, this only occurs when the engines are working at a certain number of revolutions, which are such as to make the pulsations of the propeller and the vibrations produced by the spring of the vessel isochronous, and this is also experienced in the steel boats when the speed is such that the two vibrations correspond. When this boat was going at the rate of 16 knots per hour, more than which speed she attained one day when Mr. Parsons was on board of her, no quivering or vibration was felt, but it set in when the speed was reduced to about 10 or 12 knots. He admits, however, that the manganese bronze plates supplied for this vessel are not quite so stiff as steel plates of the same thickness; but this occurred simply because in the contract no stipulation was made as to stiffness. The plates were supplied under the condition that they should stand the Admiralty test for steel plates—viz., a tensile strength of from 26 to 31 tons per square inch, with an elongation of not less than 20 per cent. before breaking, and to bend cold to a radius twice the thickness of the plate. This test the plates stood perfectly, those taken haphazard and tested by the Admiralty Inspector giving between 29 and 30 tons breaking strain, with an elongation of from 25 to 35 per cent., and bending round cold to half the radius stipulated.

CORRESPONDENCE.

LOAD FOR CAST-IRON COLUMNS.

To the Editor of IRON.

SIR,—I shall be obliged if some of your readers will give me, through your columns, the following information:—The safe load for cast-iron columns 11 feet long, $4\frac{1}{4}$ diameter, $1\frac{1}{4}$ metal, or 2 inches internal diameter, caps and bases 8 inches square, and standing on stone at bottom and carrying girders at the top. Also the theoretical breaking weight.—I am, &c.,

A CONSTANT READER.

Worthing, Dec. 30.

THE TAY BRIDGE ACCIDENT.

To the Editor of IRON.

SIR,—It does not seem very clear at present whether the bridge gave way before the train reached the fatal spot, or whether the train was passing over it at the time of the accident. In order, however, to prevent the possibility of a train falling through a chasm in a bridge in future, would it not be better to have some automatic arrangement to inform the men in the signal cabins whether a bridge is perfect or not? I would suggest the following arrangement:—The bridge itself might be made to form a part of an electric circuit. So long as the electric circuit was complete, an electro magnet could be made to attract an armature. If the circuit were to be broken by a portion of the bridge giving way, as in the late lamentable accident, the armature would be released, and might be made to set in motion an electric bell, and thus give timely notice to the men in the signal-cabins or elsewhere to stop any trains from passing over the bridge.—I am, &c.,

December 31, 1879. CHARLES STEWART, M.A.

THE DEPHOSPHORISATION OF IRON.

To the Editor of IRON.

SIR,—In his paper on the Dephosphorisation of Iron and Steel, M. Pourcel affirms that, in the blast-furnace a high temperature is the essential agent, and that the reducing action is in direct ratio to the degree of temperature. This truth every blast-furnace manager can bear witness to. But it by no means follows that because the reduction is more perfect, the quantity of pig-iron produced is likewise greater. The reverse is the fact. Thus, by driving the furnaces in Wales with a black cinder, a larger quantity of iron was made per diem, than was possible with a grey cinder and grey iron. M. Pourcel again affirms that when the temperature is high, accompanied with a grey cinder, and a reducing atmosphere, the whole of the phosphoric acid is deoxidised, and its phosphorus remains in the pig-iron. Since iron oxide parts with its oxygen more readily than phosphoric acid, both being present in a reducing atmosphere. Therefore, when there is a dark cinder, and mottled, white or crude steely pig-iron, due to a deficiency of reducing atmosphere in the furnace, the whole of the iron oxide present is not reduced, whilst the phosphoric acid, more difficult of reduction than the iron oxide, is either only partially reduced, or wholly remains in combination with bases in the slag; with lime, in fact, as Messrs. Pattinson and Stead affirm. Now, M. Pourcel's assertion is fully borne out by certain facts. When the Welsh furnaces made grey pig, the puddlers would not puddle it. And why? Because it had so much phosphorus in it that the labour of cleansing it was very great. But with the white pig, made when the furnaces worked fast, with dark cinder, the puddling became far easier, because the phosphorus had most of it passed off in the cinder, as phosphate of lime, and, as I think, sometimes also as phosphate of iron.

Again, in the manufacture of malleable castings, grey pig does not answer, because it contains phosphorus, and its presence is fatal to the softness and tenacity these castings demand. Therefore, mottled, white, or crude steely pig is invariably employed, because it is practically free from phosphorus. If Berthier thought that a limey slag and a high temperature in the blast-furnace would eliminate phosphorus from the iron, his opinion is fully shown to be fallacious by the facts I have cited. M. Pourcel's equation R = Ft. is perfectly correct, and R varies directly as the temperature. In his example of the reduction of forge cinder to white iron, showing that the iron produced has more phosphorus than when reduced from ores containing a like amount of phosphorus as the forge cinder, M. Pourcel affirms that the forge cinder has the phosphorus as phosphate of iron, whilst the ores have it as phosphate of lime, alumina, &c. Here his opinion conflicts with that of Messrs. Pattinson and Stead, who declare that no phosphate of iron is in the slag, but only phosphate of lime. For myself, I believe that some cinders contain only phosphate of lime; but some, both phosphate of iron and lime, and some phosphate of iron alone. Else, how, by M. Pettitt's process, without lime, was the phosphorus separated? A large quantity of iron ore could, no doubt, as M. Pourcel remarks, be introduced into the converter, when highly silicious pig is operated upon; but why introduce a large quantity in excess, by throwing it in, when the lesser necessary quantity can be more efficiently blown in, and if, again, by desiccating the blast by Mr. Fryer's process, the temperature may be notably increased?

With regard to the effect of silicon. When free silica is present in the converter, it will seize upon the oxide of iron in any phosphate of iron which may have formed, and form a silicate of iron, setting free phosphoric acid; and the carbon present will deoxidise this acid, and liberate its phosphorus, to return to the metal. So far, then, from the silica removing phosphorus from the metal, it acts as an agent, effecting the restoration of the latter to that metal. When the converter lining is of ganister, the phosphorus does not separate from the metal, even by an overblow; nor will it separate in such a converter, even though a large quantity of iron oxide be thrown in. But when the oxide is blown in, the result is different, and the phosphorus is removed, notwithstanding the presence of the silica. Also, when the silica is neutralised by lime, then the throwing in of iron oxide effects, with the overblow, the separation of the phosphorus from the metal. It is certain that lime and oxide of iron will separate the phosphorus, but it has not yet been shown in practice that lime alone will do so. Even in the lime process, it is necessary, at the last, to generate uncombined oxide of iron by an overblow, in order to ensure success. In the Pettitt process, on the other hand, iron oxide alone effects the separation of the phosphorus, irrespective of the lining of the converter: whilst the metal needs no addition of spiegel or manganese to render it fit for the manufacture of steel rails of excellent quality.

The blowing-in of iron oxide renders the Bessemer process merely a refined edition of the puddling furnace. Air and oxide of iron are, in both instances, the active agents. As the puddling furnace succeeds without the aid of lime, so does the Bessemer, when the melted iron is treated with the same agents, viz., air and oxide of iron, atom for atom. And in this case, spiegel, as in the puddling furnace, may be dispensed with—at all events for heavy work, such as steel rails. The liability of the Ponsard charge to set, or to become pasty, may probably be overcome by the adoption of Mr. Fryer's desiccating process, applied to the blast, and thereby raising the temperature.

In the Bessemer converter, says M. Pourcel, the silicon and the phosphorus are simultaneously oxidised, though probably the oxidation of the silicon is more rapid than that of the phosphorus. Silica, then, and phosphoric acid are present; the silica seeking a base whereto to unite itself, and the phosphoric acid, exposed to the carbon present, is deoxidised thereby, and restored to the metal. This goes on until all the silicon is oxidised, and the carbon begins to form carbonic oxide, which, as fast as phosphorus continues to be oxidised, reduces the acid formed, and restores the phosphorus to the metal. As yet, the silica is inert, as regards both the phosphorus and the iron; but when, from the diminution of the carbon the iron itself begins to burn, then oxide of iron is formed, and would, were it not for the free silica, remove the phosphorus as phosphate of iron; because there is no longer carbon present to deoxidise the phosphoric acid and so permit the reunion of the phosphorus and metal. But the free silica now plays its part, and, combining with the oxide of iron, prevents the formation of phosphate of iron, so that the phosphorus remains in the metal. Whatever, therefore, can be introduced which shall constitute a base which the silicic acid will prefer to oxide of iron, will enable the operator to extract all the phosphorus, provided only that the basic matter shall be enough to saturate the silicic acid present.

I see Mr. E. Riley has taken out a patent for decanting one converter into another converter, so as to get rid of the silicic slag. Seventeen years ago, when the Titanic Company was formed to carry out my inventions in connection with the Bessemer process, the company's engineer, Mr. R. C. May, furnished, at my request, drawings of a pair of converters, arranged for the very purpose, or process, now patented by Mr. Riley. However, as the Titanic Company never erected a Bessemer apparatus, but contented themselves with a small experimental work for crucible steel, Mr. Riley has now the benefit of their neglect, should the process prove, as I think it probable, a success. In conclusion, I wish to mention, that I find that M. Pourcel never received the letter I addressed to him, and to which I referred in a previous letter, so that I have unwittingly taxed him with a want of common courtesy, which I very much regret, and of which he has now shown me he is wholly undeserving.—I am, &c.,

R. F. MUSHET.

Cheltenham, 22nd December, 1879.

THE DEPHOSPHORISATION OF IRON.

To the Editor of IRON.

SIR,—The dephosphorisation of iron is a subject that has for many years greatly interested every one connected with its manufacture; and at the present time more especially, everything bearing on the subject is sure to command some degree of attention. I have therefore thought that the following remarks may be not without interest to some of your readers.

The Thomas-Gilchrist process for making steel in the Bessemer converter from phosphatic pig-iron does not appear, so far as I can judge, to be a perfect practical success at the present moment, at all events in this country. That is to say, there are some difficulties and drawbacks still remaining to be overcome. That they will be overcome before any great lapse of time is certain, because the principle of the process is sound as shown by the results already obtained. As far as I can gather from what has been said and written on the subject, one difficulty has been and still is the destruction of the lining and more especially of the bottom. This is caused, I need scarcely say, by the corrosive action of the silicic acid produced by the oxidation of the silicon in the pig; and what makes the destruction so great is that the silicate formed is in itself a powerful corroder of the lining, and thus the destruction continues during the whole time of the blow. Silicon has, however, been always considered a necessary evil, inasmuch as without it the requisite heat could not be obtained.

It has been attempted to preserve the lining, by throwing in lime or some other base for the silica to combine with, and also by injecting fine lime through the tuyeres. The latter plan, which would undoubtedly be the best, will I am afraid develop considerable difficulties when carried out in practice. The former I can scarcely suppose to be very effective, because the materials would not come into sufficiently intimate contact with the iron if in lumps, and would be blown out if in powder. Both plans, however, although to a certain extent they may be successful, cannot be so entirely; because, as already explained, the slag they go to form has itself a corrosive action on the lining. From the accounts in your paper of what is being done at Horde, it appears that they find the silicon can be in great measure dispensed with, and the destruction to the lining consequently diminished by the employment of iron containing about 2 per cent. to $2\frac{1}{2}$ per cent. of phosphorus, which, by its combustion, supplies the requisite heat to the bath, and produces a slag that, unlike the silicic slag, has little or no solvent action on the lime lining and bottom. But although this plan disposes of one difficulty it raises up another, as I will endeavour to explain.

It is almost impossible, as far as my experience goes, to produce in a coke furnace a pig-iron very low in silicon without giving it a considerable percentage of sulphur, which would be largely increased if tap or flue cinder were used in the blast-furnace burden, and this would have to be done in order to procure the necessary quantity of phosphorus. It will be said that this evil is not a very serious one, as the sulphur can be neutralised by the addition of manganese. No doubt manganese has this effect to a certain degree, and at the same time gives the steel a finer grain and makes it work well in the rolls, but it is more harmful to the quality than is generally supposed—it tends to make the steel hard and brittle and to fly when chilled in water. A good soft steel could never be made with sulphur and manganese, and even rails made in this way would be very inferior in quality. I consider that this practice of using a low quality or No. of pig-iron, and then making the steel workable by adding a large quantity of manganese, is far too general in this country and renders the steel unsuited for many purposes. I think however that this difficulty is not by any means insurmountable. During the spring of 1875, my father, Mr. Arthur Warner, addressed several letters to IRON as well as some of the other engineering papers, relative to his process of refining pig-iron, and this process it seems to me might be made available with considerable advantage for the purpose of procuring a suitable iron for the Thomas-Gilchrist process. I should burden the blast-furnace with such a mixture of cinder and Cleveland stone as would produce a good grey iron containing from 2 to $2\frac{1}{2}$ per cent. of phosphorus and a like quantity of silicon. This iron would be fairly free from sulphur, if the burden were not over heavy, the heat of blast high, and a good dose of limestone used. The silicon could then be reduced to 0·5 per cent. by our process (or any other proportion that is better), and the last traces of sulphur eliminated at the same time.

The operation would be very simple and the cost slight. Of its effectiveness and reliability there is good proof, as we have had the process in operation at our works for some years and know its exact cost. I am aware of no other process by which the silicon can be brought down to any required percentage, while at the same time the carbon is increased if necessary and the sulphur eliminated. A very slight additional plant would be necessary. When taking the iron direct from the blast-furnace as carried out at the works of Messrs. Bolckow, Vaughan and Co., it is necessary to have a ladle on a carriage into which the iron is tapped and conveyed to the converter. The only alteration required would be a ladle deep enough to contain the purifying ingredients as well as the iron, and a chimney or cover fixed in the position where the iron is run in, to carry off the flames. As soon as the action is over, which will be from five to ten minutes, the ladle can be taken to the converter and the refined iron tapped in.

We regularly make six casts per shift from the same ladle at our works, as the flux prevents all skulling up the sides,

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and a ladle will run in this way for some weeks without repairs. The total cost would range from 6s. to 7s. 6d. per ton, labour included; and when the reduced cost effected in the pig-iron by the use of cinder, the saving in the lining of converters, the improved quality and the difference in price between hæmatite and Cleveland iron, now about 50s. per ton are considered, there would appear to be a considerable balance in favour of the course I have pointed out. When the iron is remelted in a cupola, the apparatus used for refining would be the same as that described for the blast-furnace.—I am, &c., A. M. WARNER.

Cargo Fleet, Middlesborough-on-Tees.

NEW BOOKS.

Outlines of a Course of Natural Philosophy. With Examination Papers. By Dr. G. Molloy. Crown 8vo. (Simpkin and Co.)

Encyclopædia Britannica. The Ninth Edition. Part 39. 4to. (Black.)

Brain; a Journal of Neurology. Part 8. 8vo. (Macmillan and Co.)

Dictionary (A) of Music and Musicians. Edited by G. Grove. Part 9. 8vo. (Macmillan and Co.)

Pharmacology and Therapeutics. By T. L. Brunton. Crown 8vo. (Macmillan and Co.)

Reciprocity, Bi-Metallism, and Land-Tenure Reform. By A. J. Wilson. 8vo. (Macmillan and Co.)

Year-Book (The) of Facts in Science and Art, for 1879. By J. Mason. Fcap. (Ward and Lock.)

Oliver and Boyd's New Edinburgh Almanac. 1880. 18mo. (Simpkin and Co.)

BOOKS RECEIVED.

The Crayfish: an Introduction to the Study of Zoology. By T. H. Huxley, F.R.S. London: Kegan Paul and Co.

Lightning Conductors; their History, Nature, and Mode of Application. By Richard Anderson, F.C.S., F.G.S. London: E. and F. N. Spon.

The Gault. A Lecture. By F. G. Hilton Price, F.G.S. London: Taylor and Francis.

A History of Precious Metals from the Earliest Times to the Present. By Alexander Del Mar, M.E. London: G. Bell and Son.

IRON TRADE REPORTS.

BARNSLEY AND SOUTH YORKSHIRE.—During the last fortnight but little work has been done at some of the district ironworks, where miscellaneous castings are produced, owing to the Christmas and New Year holidays. The blast-furnaces have, however, been kept fully going, and are turning out a large quantity of capital pig-iron, a good deal of which is supplied on account of existing orders. The stove and grate trade is only moderate, and the same may be said with regard to colliery castings. The Bessemer steel works are in receipt of some good orders, more especially for rails and tires, which have of late been largely manufactured. The output of coal at the leading collieries throughout the district has during the fortnight been but limited. Most of the pits ceased work on Christmas eve, and did not resume operations until Monday last. There has, however, been no lack of supplies, either for London or the disteict. The demand for both Silkstone and Barnsley house-coal is just now pretty lively but there is no material alteration in prices. The traffic, *via* Doncaster and forward over the Great Northern line is well sustained, the block referred to a fortnight ago having been completely removed. In connection with the late block, a suggestion has been thrown out that the Manchester, Sheffield and Lincolnshire Railway Company ought to construct a short line from Mexborough or Conisborough to Ratford, which would relieve Doncaster of the whole of its south traffic from the Barnsley district, and this, it is held, ought to be done soon, inasmuch as when the Great Eastern system is extended to Doncaster the difficulties will be increased rather than otherwise. The demand for house-coal for local markets holds well up, but competition in all branches is very keen, which has a tendency to keep prices down. The position of the coal trade is not nearly so active as it was a couple of months ago, owing to the closing of the Baltic and other foreign trade. The usual monthly meeting of the members of the South Yorkhire Steam Coal Miners' Association was held on Tuesdays at the King's Head Hotel, Barnsley; but it is understood that no alterations were made in prices, which are still low. The usual business was transacted, and the members dined together. Most kinds of fuel, in addition to those referred to, are in not over good request, engine fuel realising but a short price. It is satisfactory to learn that the coke trade remains active, and even with the large additional output a fair clearance is effected. The tonnage passing over the Manchester, Sheffield and Lincolnshire line of railway to North Lincolnshire is a large one, and the prospects of additional furnaces being blown in is having a tendency to increase the demand.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—There is never much business done at the close of the year, and this week is no exception to the rule. Makers have been more or less away from business, or have been as usual squaring up their books at the close of the year. But probably the more cogent reason of their absence from commercial circles is to be found in the fact that they are all very well sold forward, that they have very little iron to sell, and that their hands are, practically speaking, filled for some months to come. It is obvious that whatever conditions may rule the market, makers will be very busily employed for a considerable period of time, as the orders at present held represent a very large aggregate of metal. Even the high prices offered by buyers cannot, in many instances, secure the acceptance of orders. Purchases have been made at upwards of 100s. per ton, at makers' works, for best qualities of Bessemer iron, and at 97s. 6d. for No, 3 forge, with commoner qualities at 95s.; but at Barrow the official quotations are represented by the following figures:—All-round qualities of Bessemer, 110s. per ton f.o.b.; 105s. for No. 3 forge, and 100s. for the inferior qualities of hematite iron. There is still every effort being made in the direction of an increased output of iron. Not only are furnaces which for months have been standing idle being put into blast, but new ones are being built, and their construction is being pushed forward with all despatch. There is very little pig-iron in hand, except where the orders are accumulating stocks prior to shipment. Although the winter season is at its height, large shipments of metal are being made from Barrow of Ulverston, Askam, Barrow and West Cumberland iron to Baltimore, North America, and there are indications that a very large tonnage will be shipped during the winter months. Iron ore is a very scarce commodity. Prices are high, as much as 27s. 6d. to 30s. per ton being asked at the mills for the best samples. The coal and coke trade improves in tone every week. There is a considerable demand, but the supply is equal to it. Prices, however, are going up a little. Shipping quiet, as is usual this time of the year.

BIRMINGHAM.—Many of the leading manufacturers were compelled to work overtime during the early part of Christmas week to complete contracts. As but few orders, and these chiefly from the United States, were placed by merchants or factors, and as very little movement can be anticipated in the home trade for some weeks to come, order-books generally will not be over-burdened at the commencement of the new year. Stock-taking has been practically the work of the past week, and it may fairly be anticipated that amongst ironmasters and the manufacturers of the heavier descriptions of goods, such as tube, cut-nail, and tin-plate makers, and metal-rollers, the recent continuous advances in value will have the effect of bringing out a satisfactory return. Neither in bulk nor in value are orders in the local hardware trades, which have been carried forward to the new year of any importance. Galvanised sheet makers, who have been kept fully employed of late, are beginning to experience a falling off in orders, and do not find it so easy to keep their order-books up to the standard of the last few months as has hitherto been the case. From the Canadian markets and from British India a somewhat brisk demand has exhibited itself for carriage ironwork, lamps, nuts, and bolts, fencing, and railway material. Local firms of metal-rollers are also executing orders of considerable magnitude for copper sheets, which have come to hand from Russia, and also from China, and other markets in the East. The slackness of the Colonial trade, coupled with the stagnation in the home building trade, keeps brass-founders quiet, and the scarcity of Australian shipping orders is severely felt in the hollow ware branch. Still, this department of local industry has quite recently shown some improvement, attributable doubtless to the anxiety of home consumers to get their orders placed before the further rise in the price of pig-iron, which is seen to be imminent, leads to a corresponding advance in values. Edge-tool makers report business as quiet. Tube-makers are full of orders and are declining to accept specifications unless subject to the rates of the approaching quarter day. The chandelier and gas-fitting branch is fairly active, and some good contracts for gasometers, tanks and other constructive work are being carried on by local houses. A brisk demand for rails and chains has recently sprung up in the Indian markets. Prices of pig-iron have been very firm, and in cases where orders are forced upon smelters an advance on previous quotations is required. Prices have acquired additional strength from the circumstance that there is a very general feeling amongst the local coalmasters, that at quarter-day, an advance in prices must be made, accompanied by a corresponding increase in miners' wages. It is pretty generally understood that iron will also be advanced, and that few transactions have taken place within the last few days have been chiefly subject to quarter-day's quotations. The prevalent opinion seems to be that marked bars will be raised to at least £9 per ton. Some persons do not hesitate to fix the basis at £10; but this increase of £2 per ton is not generally regarded as probable. For unmarked bars for forward delivery as much as £8 10s. has been asked by several firms, and for common sheets (singles) £10 to £10 10s. is the current quotation. The recent advance in the bars made tin-plates firmer, and there has been a brisk demand for coal at full rates in anticipation, doubtless, of the coming rise, which is regarded as a certainty. The operatives in the nut and bolt trade are continuing their agitation with the view of obtaining the restoration of the 10 per cent. reduction in the scale of wages adjudged by the award of Mr. Chamberlain, as agitator in the year 1877. Three firms of employers have agreed to restore the 10 per cent. as from the commencement of the new year, but the majority declined to do so until the 1st of February, and, probably these terms will be acceded to by the men, who are to meet and determine the matter on Thursday next. On the Wolverhampton Exchange, on Wednesday, an important step was taken by the marked bar houses, who determined, at a meeting held before business commenced, to advance prices £1 per ton, in anticipation of the quarterly meetings next week. The price of marked bars is now therefore £9 per ton, with the customary 12s. 6d. additional for Lord Dudley's make. Quotations for sheets and plates became £10 to £11 for the former, and £10 10s. to £11 for the latter. Earl Dudley has advanced his prices for limestone, and is about to raise the price of furnace coal 1s. per ton, making it 11s., and to advance slack coal 6d. per ton.

THURSDAY EVENING.

Animated meeting on 'Change to-day; business inquiries numerous, and makers firmly maintained prices all round. It was not possible to buy marked bars under £9 per ton, and unmarked were quoted at 5s., less being refused.

The advance made on Wednesday has been pretty well forestalled recently in transactions effected.

CARDIFF.—The ironworks continue busily employed upon their contracts, some will be running for six to nine months to come in fulfilment of orders for iron and steel rails, at prices which, in the new aspect of things, look very discouraging. The output from Cyfarthfa is said to be getting larger than ever, and an unsolicited advance of 15 per cent. to millmen, ballers, &c., at these works and Dowlais is an evidence that fit labour is getting scarcer, while of unfit labour there will always be a stagnant stock in the best of times. The old-fashioned water-way for the Cyfarthfa iron to the port of Cardiff has been closed by the late frost. It is time that the Glamorgan Canal were converted into a railway, especially as the amalgamation of the two mineral lines, the Rhymney and the Taff Vale Railways, is believed to be drawing near. It is difficult to get hold of any Bilbao ore. This description being the best fitted for the make of the Bessemer rail, the Spaniards have been on the alert and it is held by a few hands. But the inferior ores of Bona, Algeria and Huelva are actively engaged for, and considerable speculation proceeds in delivering cargoes c.f.i. For single voyages comparatively high freights are obtainable. The coal trade, owing to contrary winds and afterwards to favourable hurricanes, is badly in want of available tonnage, and to empty waggons low prices have occasionally been conceded, but it is gratifying to note a distinct advance for forward delivery. Nothing is now booked for next year under an advance of 6d. to 1s., and the best steam is quoted 10s. colliery screened. Most colliery proprietors refuse to book at all until the labour question is guaranteed and the commercial features of 1880 are more clearly discernible. In other cases contracts have been effected with a wages advance clause. Progress is being made in arranging sliding scales. Two of the largest proprietors have, by making terms independently with their men, practically settled the steam-coal rates for the Rhondda Valley; indeed, the last one made public is viewed with such favour that it will not improbably serve as a basis for the discussion to take place next Saturday between the employers' association and the workmen delegates. Its provisions are therefore of interest. There is a minimum—the present wages—but no maximum. The advances and reductions will be made upon a fixed standard, viz, the minimum wages paid under the old sliding scale, which had ruled from 1875 to Midsummer 1879; the advances are therefore never cumulative, nor will the amount of reductions be misunderstood. When the coal of this particular colliery advances to 8s. 6d. net, the men get their first 5 per cent.; not until the price has reached 10s. will they have attained the minimum wage under the old scale; then for every 9d. additional price they will receive 2½ per cent. advance, until the price is 13s. 6d., when the advance is to be 3 per cent. for every 6d. without limit. Accountants will ascertain the figures quarterly, and, by an important proviso, if other collieries adopt the same scale their selling prices shall be taken into account in finding the average. Not more than 5 per cent. of the men are to leave or be dismissed in any one month, but it is evident that if attracted by other sliding scales more favourable to them in six months 30 per cent. of the men now bound by signature can have taken their departure, and it may be difficult to get their places filled on the same terms. A scale for the whole district would have lent greater stability to the whole trade, and it is this the action of the Monmouthshire and South Wales Coal Association will practically accomplish, for the seceders are only a small minority.

CLEVELAND.—There was a good attendance on Change at Middlesborough on Tuesday—not the least like holiday time. Prices, though a little flatter than the preceding day, in consequence of the fall in the Scotch market, were firm and hopeful. No. 3 easily realised 52s. prompt delivery, 53s. 6d. over the first three months, and 55s. over the second three months of 1880. There is a great scarcity of forge iron, and there is an increasing demand. It was never imagined that it could fetch its present price. Little, if any, is held by merchants, so that makers have the full benefit. Ironfounders are becoming busier. The finished-iron trade is maintaining a firm tone, orders being plentiful, and makers being well filled up for some time to come. Steel plates £8 10s. to £8 15s.; angles, £7 12s. 6d. to £7 15s. The coal and coke trade continues to improve.

DERBYSHIRE.—Since our last notice the coal and iron trades throughout the Derbyshire district has been but little prosecuted owing to the holidays. The ironworks are in receipt of fair orders, and it is hoped that when the new year has fairly set in a moderate business will be transacted. The output of pig-iron is much larger at the present time than it was a few months ago, owing to the blowing over of additional furnaces. A goodly number of the collieries are making from four to five days per week, whilst some are working full time. There has been no falling off in connection with the demand for London and the South, so that a good tonnage is being sent over the Midland line from Clay Cross, Eckington, Langley Mill, and other places. Prices of all kinds of fuel are not much better so that many coalowners are compelled to work for a very small margin of profit, if they are fortunate enough not to work to a loss; the business doing in steam-coal as well as in small fuel is not over active, but the make of coke is increasing rather than otherwise, and many additional ovens have of late been lighted.

FOREST OF DEAN.—The sudden change of the weather will not favourably affect the house-coal industry of this district where the quotations are at variance with those of competing districts, and a difference of several shillings per ton arises between it and South Wales. Merchants are complaining that by the December "rise" their West of England trade has been largely sacrificed, and that, in fact, the customers in those parts have flown away from them to the Principality. There has been no alteration in prices since the advance at the beginning of December already published in IRON. Regarding the outlook for the new year there is no apparent prospect of an enlarged trade in coal, and there is but little prospect that such will be realised. With the severe competition for South Wales, where the prices can be hardly remunerative, the Forest may rest somewhat content in maintaining their hold where railway advantages are favourable. The Severn bridge route strengthens in interest, and an increasing traffic with Forest coals has been shown during the last month. The iron trade attracts but little interest this week beyond the fact that prices are strengthening, and quarter-day meetings anticipated with more than ordinary concern. Forest pig No. 3 will be scarcely obtainable at a lesser quotation than 100s. The demand for iron ore holds good, and prices are taking an upward course. Stocks have been to a large extent disposed of. There is quietude relative to the starting of the suspended furnaces, and it is certain that the new year opening will not find them started. The tinplate industry here is fully employed, and as with other local industries, there has been but little loss of time during the recent holiday. Best coke plates are firm at 23s. per box. It is stated that a second mill will be ready for starting this week at Parkend, when the staff will be increased. Iron wire continue in good request, and the proprietor of the forges at Cinderford will commence the new year with a fair supply of orders.

GLASGOW.—The warrant market has been very strong during the past week, and prices have bounded upwards, notwithstanding the large increase that has taken place in the stocks since last year. The market at the moment is decidedly speculative, and the operators are doing their utmost to foster the idea that there is sure to be an enormous demand in the spring, and prices up to a famine height. There are reports that large orders are again coming from America, and that a considerable proportion of the iron in makers' hands has already been sold, and is awaiting shipment to the United States. On Tuesday prices were firm at 64s. 3d. to 65s. cash, remaining quiet on Wednesday at 64s. 3d. to 64s. 8d. cash. On Friday there was a sharp advance to 66s. 6d. cash. Opening on Monday at 67s. 3d. cash and 68s. a month, prices fell to 15s. 8d. cash and 66s. 3d. a month. On the following day the price rallied to 67s. 6d. cash and 68s. a month, and on Wednesday was rather quieter, 67s. 3d. to 66s. 9d. cash and 67s. 9d. to 67s. 3d. a month being accepted. Closing buyers, 66s. 9d. cash and 67s. 1½d. a month; sellers, 1½d per ton, more. Makers' prices have further advanced, and makers of several of the favourite American brands decline to sell at any price. The demand from other markets, besides America, is slow, and the iron taken is, if anything, under the average. The shipment of pig-iron from Scotland last week were, foreign, 3475 tons, coastwise, 4045 tons, total, 7520 tons, against 5536 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 8740 tons, against 3390 tons in the similar period of last year. The total imports of English pig-iron into Scotland during 1879 were 315,000 tons, against 325,000 tons in 1878. Iron still continues to go largely into Connal's store, and the stock there is now 420,642 tons. The works in the manufactured iron trade are well off for orders for some time a-head, and prices are firmly maintained. For common bars £8 per ton is now asked, a rise of about £3 per ton since the beginning of August. Most of the works will now be closed for a few days on account of the New Year holidays. The exports last week were large, the chief item being machinery for South America, at £9853; for India, at 3410 tons; for New York, at £1380; and for the West Indies, £1225; manufactured iron for China, at £2215; and cast-iron goods for India, at £2152. The position of the engineers and founders continues slowly to improve, but very few new orders have been received by the shipbuilders during the past month. The outlook upon next year's prospects, however, is brighter than it has been for a long time back. The coal trade is still in an unsettled condition, and a number of men are out on strike; the trade is quiet, but prices firm.

LANCASHIRE.—The holidays have, as usual, interfered somewhat with business in both the iron and coal trades of this district during the past week. At a good many of the iron and engineering works a few days' stoppage is being made, and at Manchester on Tuesday there was little more than a nominal market. There is, however, still no absence of inquiry in the market, and if there were any considerable quantity of iron to be dealt with there would be no difficulty in selling it at top prices; but there is very little iron offering, and the anxiety which consumers display to cover at once any fresh requirements that may arise has a tendency to keep the market very stiff. As anticipated last week, higher prices are being asked for Lancashire pig-iron, and for delivery into the Manchester district quotations are now be given at 62s. 6d. to 63s. per ton, less 2½ per cent. for both foundry and forge qualities; but at present there is not much business being done. For outside brands coming into this market higher prices are also being asked, but there is very little to be bought except what is held in second hands, and of Derbyshire iron there seems to be none at all offering here at present. A few small lots of Lincolnshire iron are reported to have been sold for Lancashire delivery at from 68s. 6d. to 69s. per ton, less 2½; and for G. M. B.'s delivered equal to Manchester, 59s. 4d. to 60s. 4d. per ton net cash has been obtained. In the finished-iron trade prices nominally are very firm at £8 10s. per ton for bars delivered into the Manchester district, but ordeas are being refused by many of the makers, and, as a rule, any quotations are subject to quarter day, until after which it is scarcely probable that any material amount of business will be done. In the coal trade there has, if anything, been rather a lull during the past week, but the pits are still fairly supplied with orders, which are generally sufficient to keep them going about full time. In the house-fire coal trade there has been rather less doing, and the common classes of round coal for steam and forge purposes have not been moving off quite so freely in consequence of the stoppage of many of the works. Engine classes of fuel are without material change, burgy being still only in poor demand; whilst slack, although scarce in some quarters, is plentiful in others. Prices generally are steady at about late rates, and although in some quarters an advance is talked of in January, there is still too much coal offering in the market to render any further material upward movement in values probable at present, although in exceptional cases higher prices may be obtained. The average quotations at the pit-mouth remain about as under:—Best Wigan Arley, 8s. 6d. to 9s.; common, 7s. to 7s. 6d.; Pemberton four-feet, 6s. 6d. to 7s.; common coal, 5s. 6d. to 6s.; burgy, 3s. 9d. to 4s. 3d.; good slack, 2s 9d. to 3s. 3d.; and common do., 2s. to 2s. 6d., for which there is a good demand, and advanced prices are being asked for this class of fuel.

LEEDS AND WEST YORKSHIRE.—After as short a holiday as was usual in the days of greatest prosperity, work was this week resumed at all the best Yorkshire forges, with a fair prospect of some continuance. The work required and done is of a miscellaneoos kind, but chiefly boiler-plate, which is in good request, notwithstanding the preference which has been given to steel in certain quarters. There are difficulties, however, about the manufacture of steel for those purposes which are likely to retard for a considerable time that decline of the best Yorkshire iron trade which has been so freely foretold. At some forges, and notably at that of the Farnley Iron Company, plates flanged ready for putting into boilers are being made extensively, and the production of these at that establishment has been more extensive than in 1878. No great addition has been made to the railway orders already in hand, but tires, axles, and cranks are made only in accordance with some tentative specifications which have been given out; but it is expected that certain railway companies will shortly place their usual orders, so that they can be made chargeable in their next year's accounts. It may be mentioned also that the improvement which has taken place in the qualities of second-class irons, together with a decrease in prices, has caused many people to buy a fair average bar instead of usual best iron, more expensive by two-thirds as compared with Staffordshire prices. Messrs. Beacock and Taunett are well engaged on special work for India. Messrs. Tannett, Walker and Co. have on the books orders for hydraulic machinery of great power. Manning, Wardle, and Co., of the Boyne Works, have started on full time after three years of great depression. The Hunslet Engine Company are well employed on tank engines suitable for colliery work, forges, and branch railways. There is no change in the coal trade of this district; both the rate of production and prices have, as a general rule, not been altered with the opening of the new year.

LONDON.—The metal market here certainly exhibits every sign of steady and permanent improvement. The year 1879 which came in bringing weakness and depression, leaves us full of hope and satisfaction with regard to the future. The iron trade is still progressing and no indication is present of retraction; at least in the immediate future. Scotch pigs 67s. firm. Manufactured well maintained. Copper: the Charters for last half of December were 1400 tons of Chili Bars, closing price £65 10s. to £66. Tin: not so much excitement exists, but prices are firmer: Straits £91 10s. per quarter. Lead: strong, and realising full prices.

NORTH STAFFORDSHIRE.—Work was rerumed throughout the district after the Christmas holidays on Monday, an unusually short time having been allowed for the inspection and repair of the machinery. It has been customary to close the works from Christmas Eve until the following Monday week, and this time everything had to be done in four days. During the week a good number of specifications on account of contracts already in hand have been received, but new business is in abeyance, as manufacturers decline to quote until after the Birmingham quarterly meeting, and also to book orders except at rates current at the time of delivery. It is believed that there are plenty of orders waiting to be placed, which might have been already entered if manufacturers were in a position to execute them within a reasonable time, or were inclined to accept present prices. The next quarter day at Birmingham is looked forward to as one of more than ordinary importance, and a further advance in rates is regarded as certain. In the meantime the works of this district have plenty to occupy them fully in every branch of the trade.

SHEFFIELD.—Owing to the Christmas holidays, very little business has been done at the works in this district, but most of the iron and steel mills have now reopened, and operations are being actively continued. In the general trade of the town, cutlers and ordinary workmen have scarcely resumed business, but there are evidences that the improvement in trade which was characteristic up to Christmas will be retained through the opening months of the new year. Commercial men are of opinion that 1880, although not a year of inflation, will prove one of sound and, it is to be hoped, good trade. Messrs. John Brown and Co., of the Atlas Works, have issued the following circular to their shareholders, through their secretary:—I am desired by the directors to intimate that, owing to the intensified depression which prevailed during the first six months of the financial year, they do not think it advisable to recommend the payment of an interim dividend for the period. The prospects of the company have however, so improved by the revival of trade which has since taken place, and the increase of orders at more remunerative prices, that the directors have reason to hope the results of the whole year will be satisfactory to the shareholders."

SOUTH STAFFORDSHIRE.—This week there is not much being done at any of the shops and factories in this district. The orders that have come in during the holidays have only been small. Certain of the countries bordering on the Mediterranean sending average lines, and the West Indies are also buying. Prices continue to harden. With the new year certain of the hollow ware makers will issue circulars announcing a reduction in the discount on tinned hollow ware of 2½ per cent. The associated enamelled hollow ware makers have not at present altered their prices. The proprietors of the Old Hall Japanning and Tinplate Works have intimated their intention to advance their prices with the new year, but it is not known whether other firms will follow their example. Most of the business now doing is to satisfy the immediate wants of customers, but there are orders floating about which denote a desire on the part of buyers to lay in stocks before prices are higher. The orders, however, are not much sought after by makers, as they are only to be had at prices below those which will shortly rule. Contrary to expectation the marked ironmakers on Wednesday decided to advance the price of bars, sheets and plates £1 per ton. It was generally thought that no rise would take place till quarter-day, when an advance of £2 would be made. Bars now become £9, and sheets and plates from £10 to £11. A similar rise will be sought by the makers of unbranded iron, but whether it will be obtained it is not known.

WEST CUMBERLAND.—A very considerable demand is still experienced for all qualities of hæmatite produced in this district, and sales are reported at the advanced figures of 102s. and 105s. per ton at makers' works, for delivery in six months. There is, however, only a small business doing, because makers are producing only sufficient iron to meet their delivery engagements, notwithstanding the fact that a score of furnaces, standing idle up to a few months ago, have again been put in blast. Bessemer is largely consumed by steel makers, whose works are in full employ, and who have in hand a very large number of orders, especially for railway material. An effort is being made to produce steel plates at a price which will be commercially successful, and it is believed by many that a good trade will soon be established in this direction. From the North of England, Yorkshire, the Midlands, and even from America, a large demand is experienced for forge and the common qualities of pig-iron. Official quotations range between 100s. for white and mottled samples per ton at makers' works, to 110s. for all-round descriptions of Bessemer iron. The finished-iron trade has made a very speedy revival, and it is observable that all the mills are well employed, there being an especial demand for bars and plates at improved and improving prices. Iron ore mining is very brisk, and there is on every hand evidence of the increased demand made on the capabilities of raisers; but they are altogether unequal to it, although they are employing all the miners they have at command, and although they are working new drifts in various directions. As a consequence, there are large importations of iron ore from Spain and from Ireland. Such ore is worth 11s. to 12s. per ton, delivered, but native qualities realised 25s. to 30s. per ton at the mines. There is a great improvement so note in the coal trade.

NEW COMPANIES.

ALDRINGTON PIER.—Incorporated 20th ult., with a capital of £15,000 in £5 shares, to obtain necessary powers and to construct and maintain a pier at Aldrington, in the county of Sussex.

DUDLEY, SEDGLEY, AND WOLVERHAMPTON TRAMWAYS.—For laying and working tramways in the counties of Stafford and Worcester. This company was registered on 20th ult., with a capital of £50,000 in £5 shares.

DURHAM LEAD MINING.—Upon terms of an agreement of 25th ult., this company proposes to acquire and work mines situate in the parish of Frosterly, Durham. It was registered 20th ult., with a capital of £30,000 in £1 shares. The purchase consideration is £20,000 of which £15,000 is payable in fully paid up shares.

DURHAM SEABORNE COAL ASSOCIATION.—Registered 20th ult., with a capital of £20,000, in £1 shares, to carry on the business of coal merchants and dealers.

FLINTSHIRE GREAT CONSOLS.—This company proposes to acquire and work certain leasehold mineral property situate at Pen-y-Cyn and Cœtia Mawr, in the parish of Holywell, Flint. It was registered 16th ult., with a capital of £30,000, in £1 shares.

PATENT WHITE PRESSED BRICK.—This is the conversion to a company of the business of brick and tile makers carried on by Messrs. Clarke and Pickwell at New Holland, in the county of Lincoln. The company will also acquire the sole right to use within a radius of 60 miles from Hull Pickwell's patent process for the manufacture of the best white pressed bricks and "seconds" bricks from common red clays. It was registered 16th ult., with a capital of £12,000 in £5 shares.

SAINT PANCRAS STEAM LAUNDRY.—This company proposes to take over the steam and water-power bleach works of Mr. William Henry Smith, of Little Eaton, Derby. It was registered 20th ult., with a capital of £10,000 in £1 shares.

SILVERTOWN, CANNING TOWN, AND VICTORIA DOCK FREEHOLD LAND AND BUILDING.—The object of this company is to enable shareholders and others to obtain plots of freehold land and houses upon easy terms of payment. It was registered 20th ult., with a capital of £25,000, in £1 shares.

WORKINGTON HÆMATITE IRON AND STEEL.—This company proposes with a capital of £70,000 in £500 shares, to carry on the business of ironmasters, colliery proprietors, engineers, and steel manufacturers, and ironfounders. It was registered 18th ult.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

(Metal Market, City, Thursday Afternoon, 4 P.M.,
(*January* 1, 1880.)

METALS AND ORES.

	DECEMBER 23.		JANUARY 1.	
ORES—per ton	£ s.	£ s.	£ s.	£ s.
Red hæmatite, British (p tn)	0 15/	1 2/6	0 15/	1 2/6
Do., do., Spanish	0 17/	1 6/	0 17/	1 6/
Clay ironstone	0 17/	0 19/	0 17/	0 1/9
Oolitic	0 7/	0 10/6	0 7/	0 10/6
Manganese ores, 70%	4 0/	—	4 0/	—
Burnt iron 60% ores unit	0 0/1½	—	0 0/1½	—
COPPER (per ton)—				
Chili, for 90 per cent.	65 0/	—	65 10/	66 0/
Wallaroo	75 10/	76 0/	75 10/	76 0/
Burra Burra	74 10/	—	74 10/	—
English Tough	70 0/	71 0/	70 10/	71 0/
English Ingot, best	72 0/	72 10/	72 9	73 0/
Sheets sheathing and rod	77 0/	78 0/	76 0/	77 0/
Bottoms	80 0/	81 0/	80 0/	81 0/
Ore per unit	13 0/	13 0 4	13 0/	13 0 4
PHOSPHOR BRONZE				
Special Bearing Metal (p tn)	110 0/	—	110 0/	—
Other alloys (per ton	115 0/	130 0/	115 0/	130 0/
TIN (per ton)—				
Straits (Cash)	92 0/	—	91 10/	92 0/
Do. for arr	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	95 0/	95 10/	95 0/	95 10/
Do. Bars	96 0/	96 10/	90 0/	96 10/
Do. Refined	98 0/	—	98 0/	—
Australian	92 0/	—	91 10/	92 0/
TIN PLATES, per box, I.C. coke f.o.b. London	0 25/	0 27/	0 26/	0 28/
IX. do.	0 30/	0 35/	0 31/	0 36/
I.C. charcoal	0 28/	0 32/	0 29/	0 33/
I.X "	0 34/	0 38/	0 35/	0 39/
LEAD (per ton)—				
Soft English pig	18 10/	18 12/6	19 0/	19 10/
Do. W.B.	—	—	—	—
Spanish soft	18 7.6	—	19 0/	—
Do. with silver	—	—	—	—
Sheet milled	19 10/	20 0/	20 0/	—
Red lead	20 10/	—	20 10/	—
White	24 0/	—	24 0/	—
Patent shot	22 0/	—	22 0/	23 0/
ZINC (per ton)—from No. 9 Gauge.				
Sheets, rolled	24 0/	—	24 0/	—
Do., foreign	24 5/	—	24 5/	—
SPELTER (per ton)—				
Silesian, com	19 10/	—	19 10/	—
Rheoish	—	—	—	—
English	—	—	—	—
QUICKSILVER, bot.	7 0/	—	7 0/	—
ANTIMONY ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—

	December 27. £ s.	£ s.	January 1. £ s.	£ s.
French Star	65 0/	—	65 0/	—
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
Nickel (per lb.)	0 4/3	0 4/6	0 4/3	0 4/
Brass (per lb.)—				
Sheets, 48×24.	0 0/6½	—	0 0/6½	—
Tubes	0 0/8½	0 0/9½	0 0/8½	0 0/9½
Wire	0 0/7¾	—	0 0/7¾	—
Yellow metal	—	—	—	—
Asbestos (per lb.)	0 0/3	0 1/	0 0/3	0 1/
Plumbago (per ton)—				
Ceylon lump	13 6/	—	13 6/	—
Do. chip	10 0/	—	10 0/	—
Do. dust	8 6/	—	8 6/	—
Coals (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	December 23. £ s.	£ s.	January 1. £ s.	£ s.
Iron, per ton (at works)*—				
Bars, Welsh, common	6 5/	6 7/	6 5/	6 7/
Do. Best	7 0/	—	7 0/	—
Scotch, Common	7 10/	—	7 10/	—
Do. Best	8 0/	8 10/	8 0/	8 10/
South Stafford, common	7 5/	8 0/	7 5/	8 0/
Do. Best	7 15/	8 10/	7 15/	8 10/
Sheets, singles, Cleveland	8 0/	9 0/	8 0/	9 0/
Staffordshire	8 5/	10 0/	8 5/	10 0/
Do. doubles, Staffordshire	9 15/	11 10/	9 15/	11 10/
Scotch	10 5/	—	10 5/	—
Do. Lattens, Staffordshire	11 15/	—	11 5/	—
Plates, Ship, Stafford.	8 10/	9 0/	8 10/	9 0/
Do. Scotch	8 5/	8 15/	8 5/	8 15/
Do. Girder, Lancashire	10 0/	11 0/	10 0/	11 0/
Do. do. Stafford.	11 0/	—	11 0/	—
Do. Boiler, Stafford.	9 0/	10 0/	9 0/	10 0/
Do. Tank, Lanch.	8 15/	—	8 15/	—
Hoops, Stafford	7 10/	8 10/	7 10/	8 10/
Nail Rods, Stafford	7 17/6	9 0/	7 17/6	9 0/
Swedish in Lond.	10 10/	—	10 10/	—
Angle Iron, Welsh	7 10/	9 0/	7 10/	9 0/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 0/	6 10/	6 0/	6 10/
Do. Scotch	—	—	—	—
Rails, Welsh	5 0/	5 10/	5 0/	5 10/
Do. Stafford	8 0/	9 10/	8 0/	9 10/
North England	5 5/	—	5 5/	—
Light Rails, Welsh	5 7/6	5 15/	5 7/6	5 15/
Do. Stafford	7 10/	8 0/	8 0/	9 10/
Pig Iron at Glasgow				
Scotch warrants	3 6/	—	3 7/	—
Do. No. 1	3 7/	3 10/	3 7/6	3 15/
Cleveland, Tyne or Tees	2 1/	2 6/	2 1/	2 6/
Indian Charcoal, London	—	—	—	—
Wrought Iron Girders	13 0/	18 0/	13 0/	18 0/
Bolts and Nuts	13 0/	15 0/	13 0/	15 0/
Fish Bolts	13 0/	20 0/	13 0/	20 0/
Washers	13 10/	14 0/	13 10/	14 0/
Rivets	10 0/	13 0/	10 0/	13 0/
Spikes	12 10/	14 10/	12 10/	14 10/
Swedish Iron— f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	10 10/	—	10 10/	—
Do. hammered	10 10/	—	10 10/	—
Billets	12 0/	—	12 0/	—
Horse Nail Rods	12 10/	13 0/	12 10/	13 0/
Belgian Iron— f.o.b. Antwerp, less 2½ per cent.				
Bars and Slit Rods, common	5 2/6	6 0/	5 2/6	6 0/
Best	5 12/6	—	5 12/6	—
Best Best	6 2/6	—	6 2/6	—
Hammered	8 2/6	—	8 2/6	—
Puddled, Steel	12 0/	13 0/	12 0/	13 0/
Bessemer	13 0/	—	13 0/	—
Hoops	7 7/6	7 15/	7 7/6	7 15/
Rails	5 10/	—	5 10/	—
Rolled Girders	6 10/	7 10/	6 10/	7 10/
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	12 0/	22 0/	12 0/	22 0/
Blister	21 0/	31 0/	21 0/	31 0/
Swedish keg	16 0/	—	16 0/	—
Milan	25 0/	28 0/	25 0/	28 0/
Bessemer rails	6 5/	—	6 5/	—
Do. tires	11 0/	15 0/	11 0/	15 0/
Do. billets	7 10/	10 0/	7 10/	10 0/
Do. ingots	7 0/	8 0/	7 0/	8 0/
Spiegeleisen—				
Manganesian, best	6 0/	6 10	6 0/	6 10/
Common, and white, per ton	5 0/	5 10/	5 0/	5 10/
Scrap (per ton)—				
Old rails for remanufacture, D.H.	4 0/	—	4 0/	—
Ditto flange or bridge	4 0/	—	4 0/	—
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal. tel., Nos. 0 to 6	14 10/	—	14 10/	—
Do. 7 & 8	15 10/	—	15 10/	—
Do. 9	16 5/	—	16 5/	—
Do. 10	17 0/	—	17 0/	—
Do. 11	17 10/	—	17 10/	—
Do. 12	18 10/	—	18 10/	—
Rolled black fencing wire (per ton) 1 to 4	8 0/	—	8 0/	—
Do. 5	8 15/	—	8 10/	—
Do. 6	9 0/	—	9 0/	—
Do. 7	9 10/	—	9 10/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 10/6	—	0 10/6	—
Do. 7 to 8	0 11/	0 11/3	0 11/	0 11/3
Galvanised, 80s. per ton extra.				
Best best annealed drawn fencing wire, per ton 0 to 6	9 15/	—	9 15/	—
Do. 7	10 5/	—	10 5/	—
Do. 8	10 10/	—	10 10/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 „ 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 „ 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 „ 16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 „ 24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

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* The entire ton consists of ten times 100 kilogrammes, or about 30 lb short of an English ton.

OILS, CHEMICALS, &c.

	December 23. £ s.	£ s.	January 1. £ s.	£ s.
Oils (per tun)—				
Olive, Malaga	—	—	—	—
Do. Gioja	—	—	—	—
Do. Levant	45 0/	—	45 0/	—
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	46 0/	—	46 0/	—
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	—	30 0/	—
Seal, yellow	27 0/	30 0/	27 0/	30 0/
Seal, brown	25 0/	—	25 0/	—
Sperm head	70 0/	—	70 0/	—
Cod	27 0/	—	27 0/	—
Whale, pale	27 0/	—	27 0/	—
Do. yellow	26 0/	—	26 0/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	32 0/	—	32 0/	—
Do. brown	30 0/	—	30 0/	30 5/
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	—	—	—	—
Palm oil, fine	36 0/	36 10/	36 0/	36 10/
Palm nut oil	36 0/	36 10/	30 0/	36 10/
Linseed oil	27 15/	28 0/	28 0/	—
Cotton seed oil	29 0/	30 0/	29 0/	30 5/
Lard	41 0/	—	44 0/	—
Cocoanut, Cochin	39 0/	—	39 0/	—
Do. Ceylon	37 5/	—	37 5/	—
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
Oil Cake (per ton)—				
Linseed, Lndn.	11 4/	—	11 5/	—
American bls.	10 17/6	—	10 17/6	—
Do. bags	10 12/6	—	1 12/6	—
Marseilles	9 2/6	—	9 2/6	—
Rape, English	4 12/6	—	4 12/6	—
Do. Foreign	—	—	—	—
Green Cotton	6 2/6	—	6 2/6	—
Tallow—PYC.	45 0/	—	45 0/	—
S. Americn. Beef	—	—	—	—
Do. Sheep	—	—	—	—
Australian Beef	35 10/	—	35 10/	—
Do. Sheep	37 10/	—	37 10/	—
Rough Town Fat.	14 0/	—	14 0/	—
Petroleum—				
Fine (per gal.)	0 0/7½	—	0 0/7¼	—
Do. spirit	0 0/7	—	0 0/6½	—
Turpentine—Spirit—				
French	—	—	—	—
American (casks)	1 9/3	—	1 11/9	1 2/
Whalefins (per. ton)—				
Davis' Straits	1100 0/	—	1100 0/	—
Arctic	1000 0/	1000 0/	1000 0/	1000 0/
Southern	500 0/	—	500 0/	—
Brimstone (per ton)—				
Rough, 2ds Ind.	7 0/	—	7 0/	—
Do. 3rds, do	5 7/6	—	5 7/6	—
Roll	8 15/	—	8 15/	—
Sulphur, Flour	11 0/	—	11 0/	—
Acid, (per lb.)				
Acetic, fine	0 0/3½	0 0/4	0 0/3½	0 0/4
Do. common	0 0/2½	—	0 0/2½	—
Citric	2 0/	—	2 0/	—
Muriatic fine (per cwt.)	0 4/	0 6/	0 4/	0 6/
Do. common	0 4/	—	0 4/	—
Nitric	0 0/4¼	—	0 0/4¼	—
Oxalic (per lb.)	0 0/5	—	0 0/5	—
Sulphuric, concentrated	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Do. Brown	0 0/0¼	—	0 0/0¼	—
Tartaric Crystal	0 1/6½	0 1/7	0 1/6½	0 1/7
Do. Pulv.	0 1/6½	0 1/7	0 1/6½	0 1/7
Ammonia—				
Carbonate, per lb.	0 0/6½	0 0/6	0 0/6½	0 0/6
Sulphate, White & grey (per ton)	20 0/	—	20 0/	—
Arsenic—White Lump (per ton)	24 0/	—	24 0/	—
Powdered, do.	10 15/	—	10 15/	—
Bleaching powder	8 0/	—	8 0/	—
Borax, Rfd., do.	1 17/	1 18/	1 17/	1 18/
Copperas (ton)	2 5/	2 10/	2 5/	2 10
Bi-Sulphide Carbon (per ton)	24 10/	26 0/	24 10/	26 0/
Portland Cement—				
1st quality, in cks 400 lb. gross, inc. csks., f.o.b., Thames, per csk	0 9/	—	0 9/	—
Do. in sks, 200lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/0 each.				
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
Hypophosphites (per lb.)—				
Iron	0 9/3	0 10/	0 9/3	0 10/
Lime	0 5/3	0 7/	0 5/3	0 7/
Magnesia	0 9/	0 9/	0 9/	0 9/
Manganese	0 9/	0 9/	0 9/	0 9/
Soda	0 5/3	0 6/	0 5/3	0 6/
Lead (per cwt.)—				
Acetate, best	1 18/	—	1 18/	—
Nitrate	1 14/	—	1 14/	—
Red	0 19/6	—	0 19/6	—
White	1 3/	1 4/	1 3/	1 4/
Litharge (pr cwt.)	0 19/	—	0 19/	—
Lime (per ton)—				
Acetate, Grey, 85%	19 0/	—	19 0/	—
Do. Brown 70%	11 0/	11 5/	11 0/	11 5/
Potash—				
Bichromate (lb.)	0 0/7	—	0 0/7	—
Chlorate (pr. lb.)	0 0/7¾	—	0 0/7¾	—
Muriate, 80% ton	5 17/6	—	5 17/6	—
Pruss. Red (lb.)	0 1/8	0 1/10½	0 1/8	0 1/10½
Do. Yel. lb.	0 0/10¾	—	0 0/10¾	—
Sulphate, 80% (per ton)	9 0/	10 0/	9 0/	10 0/
Saltpetre (per cwt.)—				
Engl. refnd. kgs.	1 7/6	—	1 7/6	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
Soda—				
Ash ... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 11/	—	0 11/	—
Caustic, 60%	—	—	—	—
Do. 72%	—	—	—	—
Nitrate	0 18/	—	0 18/0	—
Crystals (per ton)	3 12/6	—	3 12/6	—

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* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 20s.

RISE IN IRON AND COAL.—On Wednesday the marked bar iron manufacturers of South Staffordshire met at Wolverhampton, and decided to advance the prices 20s. per ton. This makes the new basis £9 per ton. with 12s. 6d. extra for Lord Dudley's Round Oak iron. With the advance the ironworkers will get 1s. per ton for puddling, and 10 per cent on the millmen's wages. Thick coal will be advanced 1s. per ton to-day, and Cannock Chase sorts will also go up at the same time by 2s. for best coals, 1s. 6d. for seconds and 6d. on fine slack. This week Lord Dudley's limestone was advanced 6d. per ton, fixing blast furnace stone at 4s. 6d. and masonry stone at 3s. 9d. per ton, short weight.

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 5792 to 5312, being the entries from Dec. 19th to Dec. 29th.

NEW APPLICATIONS.

Advertising Apparatus.—*J. O. Spong, London.* [5261
Alarm Bells.—A communication.—*S. Pitt, Sutton, Surrey.* [5195
Apparatus for Raising Water.—A communication.—*J. C. Mewburn, London.* [5287
Apparatus for Sparing Power.—A communication.—*G. W. von Nawrocki, Berlin.* [5201
Artificial Leather.—A communication.—*G. E. Vaughan, London.* [5220
Axles and Shafts.—*J. C. Evans, London.* [5193
Balling Fibrous Materials.—*J. Bottomley, Buttenshaw.* [5200
Belt Fasteners.—A communication.—*G. F. Redfern, London.* [5233
Bending and Corrugating Plates and Tubes.—A communication.—*C. Pieper, Berlin.* [5258
Bicycles.—*G. Singer, Coventry, and W. Granger, Birmingham.* [5244
Bicycles.—*N. Salamon, London.* [5268
Bicycles.—A communication.—*H. H. Lake, London.* [5284
Boiler Machinery.—*J. Garvie, London.* [5289
Boots and Shoes.—*J. Keats, Bagnall Hall, Stoke-upon-Trent.* [5269
Bottle Stoppers.—*N. Fritzner, Berlin.* [5264
Breech-Loaders.—A communication.—*W. R. Lake, London.* [5225
Casting.—*T. Thorp, Whitefield, and R. Tasker, Prestwich.* [5263
Cast-Iron Pots.—*T. Holcroft, Wolverhampton.* [5278
Charging Gas Retorts.—*A. Q. Ross, Cincinnati, U.S.A.* [5209
Cigar Holders.—*J. G. Meyers, London.* [5231
Cleavers for Drawing Rollers.—*J. L. Taylor, and T. H. Rushton, Bolton.* [5221
Closing Carriage Heads.—*A. Wood, Folkestone.* [5210
Colouring Matters.—A communication.—*J. H. Johnson, London.* [5305
Cork Screws.—A communication.—*J. G. Wilson, Manchester.* [5246
Cutting Paper.—*T. H. Pitt, London.* [5241
Dyeing Apparatus.—*A. M. Clark, London.* [5255
Electric Lamps.—*G. G. Andre, Dorking.* [5206
Engine Valves.—*J. H. Johnson, London.* [5239
Extracting Machines.—A communication.—*F. Wolff, Copenhagen.* [5294
Fastenings for Bonnets.—*W. W. Tambs, Birmingham.* [5306
Furnaces.—*J. F. Flannery, London.* [5227
Furnaces.—*R. S. Newall, Gateshead-upon-Tyne.* [5230
Furnaces.—*J. W. Chenhall, Morriston, Glamorganshire.* [5280
Furniture.—*J. Watson, Sunderland.* [5215
Fire-Lighters.—*A. B. Labayle, Mont de Marsan, France.* [5282
Galvanic Batteries.—*T. Coad, London.* [5219
Gas Apparatus.—*J. Wild, Huddersfield.* [5275
Gas Lamps.—*W. T. Sugg, London.* [5267
Gas Manufacture.—A communication.—*H. A. Bonneville, Paris.* [5310
Gas Stoves.—*H. Salisbury, London.* [5236
Gas Stoves.—*A. H. Smith, Clifton, Gloucestershire.* [5283
Glass Saucer.—A communication.—*J. G. Wilson, Manchester.* [5248
Grinding China Clay.—*J. A. Whittaker, Helmshore.* [5213
Grinding Wheat.—*J. A. A. Buchholz, London.* [5301
Guiding Apparatus of Vehicles.—*M. Hopkins, E. T. Pellowe, and John Hopkins, London.* [5224
Harvesting Machines.—A communication.—*W. R. Lake, London.* [5204
Homogeneous Steel.—*G. de Laval, Stockholm.* [5199
Horseshoes.—*H. Ward, J. Ward, and W. Ward, jun., Leeds.* [5216
Hurrys.—*A. M. Stewart, Irvine, Ayrshire.* [5300
Hydraulic Valves.—*H. N. Maynard, London.* [5195
Incubators.—*M. W. M. Swyndregt, London.* [5203
Iron and Steel Manufacture.—*G. E. Dering, Lockleys, near Welwyn.* [5211
Knitting Machines.—*W. Cotton, Loughborough.* [5217
Landaus, &c.—A communication.—*W. R. Lake, London.* [5262
Life-Saving Apparatus.—*D. M. Somerville, Liverpool.* [5250
Looms.—*J. A. Radcliffe and W. W. Bradbury, Rochdale.* [5249
Looms.—*J. Burnett, Preston, and J. Garstang, Burnley.* [5191
Lubricators.—A communication.—*J. Cassels, Liverpool.* [5309
Lucifer Matches.—*J. H. Howard, London.* [5208
Magazine Firearms.—*W. Trabue, Louisville, U.S.A.* [5240
Matrices.—*G. D. MacDougald, Dundee.* [5242
Melting Tallow, &c.—*W. McDonnell, Limerick.* [5235
Metal Guards for Shutters.—*R. J. Worral, Liverpool.* [5222
Middlings Purifying Machines.—*A. B. Childs, London.* [5303
Mincing Machines.—*J. W. Sutton, London.* [5281
Moreens and Similar Fabrics.—*C. T. Smith and W. Binns, Bradford.* [5288
Motive-Power.—*A. Nicolaides, Constantinople.* [5256
Motor Governors.—*H. J. H. King, Newmarket.* [5254
Moulding Machinery.—*H. Kinsey and G. Challenger, Swansea.* [5237
Neckties.—A communication.—*H. H. Lake, London.* [5293
Night Soil Pans.—*H. Ward and J. Ludlow, Birmingham.* [5260
Paddle Wheels.—*R. Jack, Glasgow.* [5273
Painting Apparatus.—A communication.—*E. Edwards, London.* [5298
Perambulators.—A communication.—*J. C. Mewburn, London.* [5198
Photographs on Earthenware.—A communication.—*A. M. Clark, London.* [5223
Point Rails for Railways.—*J. S. Williams, Riverton, U.S.A.* [5214
Portable Forges, &c.—*A. B. Holmes, Derby.* [5279
Posts for Telegraph Wires.—*J. S. Williams, Riverton, U.S.A.* [5254
Printing Ink.—A communication.—*F. Wirth, Frankfort-on-the-Main.* [5232
Pressing Hay, &c.—A communication.—*A. M. Clark, Chancery Lane, London.* [5207
Pulleys.—*A. W. Pearce, Dundee.* [5198
Purifying Gas.—A communication.—*H. J. Haddan, London.* [5197
Railway Axles.—A communication.—*W. Morgan-Brown, London.* [5285
Railway Signals.—*H. Johnson, Eccles.* [5297
Railway Switches, &c.—*J. S. Williams, Riverton, U.S.A.* [5270
Removing Cream from Milk.—A communication.—*E. P. Alexander, London.* [5271
Revolving Cylinder Firearms.—A communication.—*W. R. Lake, London.* [5266
Revolving Shafts.—*C. J. Appleby, London.* [5226
Road Locomotive.—*G. P. Harding and W. L. Holt, Paris.* [5312
Safety Lamps.—*J. E. Bennett and I. Solomon, Sheffield.* [5247
Safe and Table Desk.—*H. J. Fieldus, Brighton.* [5202
Salvers, Trays, &c.—*J. A. Rhodes and J. H. Barber, Sheffield.* [5215
Self-Measuring Liquids.—*J. Sidebottom, Blackpool, Lancashire.* [5207
Sewing Machines.—*A. Keats, Newcastle.* [5252
Sewing Machines.—A communication.—*A. M. Clark, London.* [5276
Soda and Potash Manufacture.—*H. Brunner, Widnes.* [5228
Speed Indicators.—*B. Tower, Blackheath.* [5205
Stamping and Registering Letters.—*C. M. Bathias, Paris, France.* [5311
Steam Generators.—*G. Allibon, Liverpool.* [5192
Steel and Iron Manufacture.—*S. G. Thomas, London.* [5302
Streets and Roadways.—*J. Gowans, Edinburgh.* [5257
Spring Mattrasses.—A communication.—*W. R. Lake, London.* [5265
Sugar Ware.—*A. E. H. Love, Liverpool.* [5251
Supporting Lace Cards.—*J. Thomas, London.* [5234
Toasting Forks.—A communication.—*W. E. Gedge, London.* [5229
Tramways.—A communication.—*F. C. Glaser, Berlin.* [5299
Tricycles.—*W. Bown and J. Derry, Birmingham.* [5295
Twin Propellers.—A communication.—*H. H. Lake, London.* [5292
Umbrellas.—*J. W. Shipman, Sheffield.* [5238

Umbrellas and Walking Sticks.—*G. H. R. Dabbs, Shanklin, Isle of Wight.* [5194
Utilisation of Furnace Slag.—A communication.—*H. J. Haddan, London.* [5253
Utilising Fish Residues.—*H. Lissagaray, London.* [5286
Valve Gear.—*A. C. Mather, Dumbarton.* [5212
Ventilating Pans.—*T. J. Bowlker, Heddon-on-the-Wall, and Matthew Watson, Maryport.* [5218
Watch Winding.—A communication.—*F. H. F. Engel, Hamburg.* [5307
Water Closets.—*W. P. Buchan, Glasgow.* [5272
Water Injectors.—*J. S. Stubbs, Manchester.* [5304
Wearing Surfaces of Engines.—*L. Perkins, London.* [5143
Weighing Machines.—A communication.—*A. M. Clark, London.* [5277
Window Fasteners.—*C. Adkins, Birmingham.* [5250
Wringing, &c., Machinery.—*W. Calvert, Leeds.* [5301

PRICES CURRENT OF MANUFACTURED GOODS.

OF

BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

[BY TELEGRAPH.]

Attendance on Change to-day good, the iron market was very unsettled and much higher prices were asked for all sorts of iron; common bars were quoted £8 10s., and it is thought marked iron will go to £10 on quarter day. There is a decided further upward tendency.

JANUARY 1, 1880.

THE position of the hardware market at the beginning of the year is in marked contrast to its position at the beginning of the year now closed, and with it closed, let us hope, a time of stagnation and of falling prices, which for duration has never been experienced to such a very great extent before. For the first nine months of the year each week brought us some lower values to declare, and the cry all throughout has been of profitless transactions and competition severe. During September, however, the iron trade began to show signs of life, and for the last three months of the year the rapid increase of that metal, and also of copper and tin, has had the effect of sending up in proportion all prices in the heavy branches of hardware, and gas tubes, cut nails, wire, bolts and nuts, patent wrought nails and hinges, wrought nails, cast-iron pipes, and malleable nails, are all advanced in proportion to the advance in raw material, and also on account of the large demand for these goods which has set in, makers have been enabled to regain their margin of profit, which is satisfactory. In the lighter branches prices have not risen so much, but in many stores we have had to alter lists, and at the present time higher prices are generally being paid for all classes of hardware, and although at first many held the opinion that it was only a "spurt" in the iron trade, and declined to replenish their stocks, they are now ordering freely at the advances which have taken place, and, as at the same time we are writing the South Staffordshire ironmasters have decided to put up the price of marked iron £1 per ton, there is every probability now that those houses who have withdrawn lists will now issue new ones based on this increased price of iron. The action thus taken, but which was not looked for before quarter day, will no doubt settle quotations all round considerably and should leave both home and foreign buyers with no hesitation as to their future requirements, and there should be at once a considerable augmentation of orders in hardware. The standard for marked iron now is £9 for bars and sheets, hoops and plates with their extras in proportion. Common bar iron stands at £7 10s., showing a margin between that and marked iron of only 30s., whereas on the 1st of January last year the difference was near 50s. This week the only farther declared alteration we have to note in manufactured goods is in hollow ware, and the discount on this has been reduced 2½ per cent., making a nett increase of 5 per cent. on tinned and about 7 per cent. on enamelled. We therefore begin the year with still upward prices and a great probability of a still further advance being immediately made.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; **Augers**, 10 to 20%. **Axes.**—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4¼ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather double nailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ½ inch, 10/6 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ½ inch nuts, 12/9 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ½ and ¼ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ½ inch, 12/9 to 13/9; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 42½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower, 70 to 72½%; solid end tower, 67½ to 70%; end Best solid tower, 62½ to 67½%; solid end barrel brass knob, 62½ to 65%; japanned Scotch tower bolts, 47½ to 55%; painters' brushes, 45 to 65%; Best, 10 to 40%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 55% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/0 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /9¾ to /10¼ per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /9½ to /10½ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11¼ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells best, 1/4 to 1/5 **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10¾ to /11½ per lb.; Brass **Escutcheon pins**, ½ by 16 inch, W.G., /10½ to 1/. **Brass jelly pans**, with bails, 1/ to 1/1; without bails, 1/1 to 1/2 per lb. **Maslin kettles**, cast, 4 to 16 inch, /10½ to 1/ per lb. **Pinpoints**, 1/3 to 1/4. Brass **Rivets** for boots, 12 to 17, W.G., /9½ to /10½ per lb. Brass **Shoe Bills**, 1/1 to 1/2 per lb. Brass **Scale pans**, 2/ to 2/2; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ½ inch and above, /10¾ to /11 per lb. Locomotive and marine boiler tubes, seamless from 1½ to 4 inch outside diameter, to 14, W.G., /8¾ to /9.

Copper.—**Copper boat nails**, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1 2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb. Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/5 to 1/6 per lb.; Copper **Wire**, 0 to 20 W.G., /10½ to /11. **Brass cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings**, 1/ to 1/6 per gross; **Cornice poles**, 2¾ inch, brass best burnished, 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35; imitation mahogany cornice poles with ends and rings complete, 2¾ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2¾ inch, light, 2/0; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2¾ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 50 to 55%; double link, iron, 45 to 50%; single link, brass, 45 to 50%; registered double link, brass, 40 to 45%; close link brass Chain, 15 to 20% brass oval lamp Chain, 30 to 35%; brass Clock Chain, 30 to 35%; japanned pillar Chains, 1 yard, 16 by 6, 6/8 to 7/6 per doz.; japanned manger, 1½ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6; japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/; **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/0; tinned watering chains, 5/ to 6/; bullock chains, ½ inch hook at each end, 17/ to 1; backbands, 17/6 to 20/; short link Chain, plain or twisted, ½ inch, 16/ to 17/; ⅝ inch, 13/ to 14/; 1 inch, 12 to 13/ per cwt.; Cart and plough traces, 18/6 to 20/6 per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 55, according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 37½ to 42½%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 30%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 50%; Common, 75%.

Door springs, X, 75 to 80%; XX, 70 to 72½%; XXX, 65 to 67½%; XXXX, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal, 50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 60 to 62½% common, 67½ to 70½%; kitchen **Fireirons**, in sets, /5½ to /6½ per lb.; tongs only, /6 to /6½; pokers only, /5¼ to /5¾ per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light-kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 27/ to 28/ per doz.; bright fronts, 30/6 to 33/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 36/6 to 40/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 41/6 to 45/. Cut wire **Fencing staples**, 0 to 6, 18/ to 20/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 61½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 55 to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs**, two prongs, 5/9 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 33/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37 per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 42½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50% ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 65%; strong, 42½ to 55%; patent Scotch butts, 55 to 57½%; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 55%; extra strong bed hinges, 45 to 57½%; patent chest, 50 to 60%; patent strap, 50 to 57½%. H Hinges, 42½ to 57½%; HL hinges, 42½ to 57½%; japanned and garnett hinges, double washered, light and strong, 40 to 45%; best best patent London or Lancashire tees, 55 to 62½%; patent light japanned Scotch Tees, 57½ to 65%; light patent hooks and hinges on plate and to drive, 22½ to 32½%; weighty patent hooks and hinges, weighty Gothic, 19/6 to 24/6; scolloped edges, not japanned, 20/6 to 23/6; Scotch japanned, Tees double washered, 19/ to 22/; Gothic Scotch japanned, Tees 21/6 to 26/6; Gothic Scotch, Tees self colour, 10/ to 23/. **Wrought hinges**, common and best, 37½ to 47½%; best best, 32½ to 37½%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 26/ per cwt.; **Lancashire hinges** wrought, 32½ to 37½%; **Pressed hinges**, common, 62½ to 65%; best, 52½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net; **horseshoes**, fullered fore, 17/6 to 19/; fullered hind, 18/6 to 19/6/; stamped, fore, 17/6 to 19/6; hind, 17/6 to 19/6. **Hollowware**, 45½ to 50½%; common to best, enamelled, 20½ to 2 ½%, delivered in Liverpool, London.

Ironfoundry, general.—Ash grates, 10/ to 12/, air bricks, 2/9 to 3/6, half, single, 3/6 to 4/1, double, 6/ 3 to 7/; bars and bearers, 8/6 to 9/6 per cwt.; barrow wheels, 9/ to 10/; bake pans, 9/6 to 10/6; cart bushes, 10/6 to 12/6; camp ovens, 9/ to 11/; cooking stoves, 11/6 to 12/6; cogs for blocks, 16/ to 18/; cellar grating, 9/6 to 11/6; clock weights, 8/ to 10/; Dutch stoves, 10/ to 12/; dumb bells, common, 8/ to 10/; best best japanned, 18/ to 20/; frying pans, cast handles, 11/6 to 13/6; frying pans with wrought handles, 16/ to 18/; furnaces, up to fifty gallons, /3½ to /4 1 galvanised furnaces up to fifty gallons, /11 to 1/2 per gallon; furnace doors, 11/ to 13/; furnace grates, 8/6 to 10/6; forge backs, 11/6 to 12/6; heaters for box irons, 7/6 to 9/6; heaters for urns, 9/ to 10/; jack wheels, 17/ to 19/; oven doors and frames, 11/ to 13/; pots, three legged, Danish, plumbers', and Nego, 9/ to 11/; plumb bobs, 12/6 to 14/6; pudding pans, 12/6 to 14/; pump spouts, 13/ to 15/; sash weights, 7/6 to 8/6 ditto, with pulleys, 10/ to 12/; shoe anvils, 10/6 to 11/6; slippers 11/6 to 12/6; **Italian irons**, 35 to 50%.

Knitting pins, iron, /4½ to /5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1 4 to 1/6 per lb.; **keys and banks**, 50 to 55%; extra strong plate, 30 to 32½%; extra strong Banbury, pin'd keys, 30 to 35%; brass shutter knobs, 52½ to 57½%; brass cupboard turns, 52½ to 57½%; brass drawer knobs, 52½ to 57½%; brass ash pan knobs, 52½ to 57½%; brass range knobs, 35 to 40%; **kettle ears**, 77½% to 80.

Lock furniture, brass, 60½ to 62½%; buffalo, 25 to 30%; china lock furniture, 37½ to 42½%; ebony lock furniture, 2¼-inch, Wilkes' spindles, 15/ to 18/ per dozen sets; sham ditto, 8/ to 9/ per dozen sets; **Norfolk latches**, common, 75 to 77½; best, 55 to 65% common **Suffolk latches**, 70 to 72½%; best Suffolk latches, 45 to 55%; tinned struck **ladle bowls**, 4-inch, 15/6 to 16/6; 4½-inch, 18/6 to 20/; 5-inch, 23/ to 25/ per gross net.

Oddwork, tinned and black, 15 to 20%, list; **Paris pointes**, best English, 12/6 to 13/; foreign, 10/3 to 11/; **planes**, 25 to 30%; iron **axle pulleys**, 1¾ inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; B. F. and wheel, 48/ to 60/ per gross; brass escutcheon pins, ½ inch to 16 W. G., 1/ to 1/2 per lb.; bright gimp pins, ½ to 19 W. G., /6 to /8 per lb.; black, /7 to /9; brass 1/6 to 1/8 per lb. Japanned cut **gimp pins**, ½ inch, /7 to /8 per lb.; tinned, /8 to /9 per lb.; cut clog or coffin pins, japanned, ½ inch, /5 to /6; tinned, /7 to /8; brass pin pointes, 1/4 to 1/6; **plate locks**, fine 45 to 55%; strong, 35 to 40%; Lancashire plate locks, 30 to 35%; pewter measures, 20 to 25%.

Netting, wire, galvanised, 57½% to 60½%, delivered **Cast nails**, lath, 9/6 to 11/per cwt.; cast wall nails 8/9 to 11/ per cwt.; cast headed bills, ½ by 8 ounce, 14 to 15/; fine round cast bills, ½-inch, 13/ to 15/; strong round cast bills, ½-inch, 12/ to 15/; cast slate pegs, 12/ to 16/; cast garden loops, 14/ to 16/ per cwt., all at works. **Patent wrought nails**, 32½ to 37½% per thousand and 27½% those sold as weighty by the cwt.; **patent machine-made horse nails**, 25 to 30%; **cut-nails**, clasp, clout or rose nails, 3 inch and upwards, 10/ to 11/6 per cwt.; cut lath nails, 1 inch and upwards, 13/ to 14/6; cut flooring brads, 2½ inch and upwards, 10/3 to 11/9; fine cut tacks, ½ inch, 34/ to 38/ per cwt.; ¾ inch 30/6 to 33/6; 1 inch, 26/6 to 28/6 per cwt.; fine cut joiners' brads, or strong, 1½ inch, 15/ to 17/; 2 inch, 14/ to 16/6; 2½ inch, 11/ to 15/; 3 inch, 13/ to 14/6 per cwt.; cut shoe bills, strong, or 12 W.G., 12/6 to 14/6 per cwt.; middle, or 14 W.G., 12 /to 14/; fine, or 15 W.G., 14/6 to 16/6; fine cut tacks, per packet, 80 to 82½%; fine cut brads, per packet, 62½ to 65%; **wrought nails**, long count, 15 to 20%; wrought nails, May, 1826 list, to 32½ 37½%; **wrought Bromsgrove nails**, March, 1878, list, 15 to 17½%; best countersunk clout nails 1, inch, 33/6 to 35/6; 2 inch, 24/ to 25/6; 2½ inch, 20/ to 23/6; best best countersunk and **half-countersunk horse nails**, fine best Swedish charcoal iron, 15/6 to 16/6% list prices; wrought rose or deck-head **spikes**, 4 inch, 13/6 14/; 5 inch, 13/6 to 14/; 6 inch, 11/ to 14/; fine, /6 to 1/ per cwt. extra; galvanised, 7/ to 8/ per cwt. extra; **wrought rose nails** for India, 2 inch, 10 lb., 19/6 to 20/6; 2½ inch, 13 lb., 18/ to 19/; 3 inch, 22 lb., 17/ to 17/6; **malleable nails**, coffin nails, black, 35 to 40%; white lacquered and gilt, 25 to 30%; sacking, 24/6 to 26/; moulders' nails and chaplets, 1½ inch to 3 inch, 27/ to 28/; bright nuggets, 27/6 to 28/; tile pegs, 14/ to 15/ per cwt.; bright nails, 4/ to 5/ extra; tinned nails, 12/ to 13/ extra; galvanised nails, 10/ to 12/ extra; **nuts**, square forged, untapped, ¼ inch, /10 to 1/ per gross; ½ inch, 25/ to 26/ per cwt.; ¾ inch, 23/ to 24/ per cwt.; square forged nuts, tapped, ¼ inch, 1/2 to 1/4 per gross; ½ inch, 30/ to 32/; ¾ inch, 27/ to 29/; forged hexagon, untapped, ¼ inch, 1/10 to 2/; ½ inch, 32/ to 34/; ¾ inch, 27/ to 29/; forged hexagon, tapped, ¼ inch, 2/2 to 2/4; ½ inch, 30/ to 42/; ¾ inch, 31/ to 33/; machine-made nuts, square untapped, ½ inch, 20/ to 22/; ¾ inch 18/ to 20/; 1 inch, 18/ to 20/; square tapped, ½ inch, 25/ to 26/; ¾ inch, 21/ to 25/; 1 inch, 24/ to 26/; machine-made hexagon nuts, untapped, ½ inch, 21/ to 30/; ¾ inch, 22/ to 24/; 1 inch, 22/ to 24/; hexagon tapped, ½ inch, 35/ to 36/; ¾ inch, 30/ to 32/; 1 inch, 28/ to 30/.

Riddles, 35 to 40%; **Rivets**, iron boot rivets, /3½ to /4 per lb.; patent machine-made Rivets, 30 to 35%; wrought tinmen's Rivets, 50 to 55%; round or panhead boiler Rivets, ½ inch, 21/ to 22/; ¾ inch, 15/6 to 17/; ⅝ inch, 14/6 to 15/6; ¾ inch, 13/ to 14/. Delivered in London or Liverpool; machine-made wire Rivets, ½ inch, 13/6 to 14/6 per cwt. **Rakes**, light garden Rakes 50 to 60%; light solid end Rakes, 47½ to 50%; bolstered teeth garden Rakes, 50%; solid end bolstered teeth garden Rakes, 40 to 45%.

Spades and Shovels, common, 55/to 57½%; second, 35 to 40%; best 30 to 35%; best strong country Shovels; 25 to 30%; best hammered Spades and Shovels, 5 to 10%; **Ship Scrapers**, black steel blades, 45 to 50%; bright, 42½ to 47½%; cast-steel black, 42½ to 47½%; bright, 37½ to 42½%; best cast-steel black, 35 to 40%; bright, 30 to 35%; iron **Wood Screws**, 75%; brass wood Screws, 65 to 67½%; copper, 45 to 50%; Stove Screws, 62½ to 67½%; dowel Screws, 52½ to 57½%; brass headlock Screws, 40 to 47%; gilt, silvered and plated head Screws, 40 to 45%; jute **Sash cord**, 52½ to 57½%; flax Sash-cord, 25 to 30%; best flax, 5 to 10%; super flax, 7½ to 12½%; extra super flax Sash-cord, 5 to 10%; patent steel ribbon **Sash-line**, 25 to 35%; copper **Sash-chain**, 52½ to 57½%; zinc Sash-chain, 47½ to 52½%; iron prepared, 40 to 45%; copper Sash-cord, 15 to 20%. **Sad irons**, common, 8/6 to 10 per cwt.; best japanned, 12/6 to 14/6; best best japanned, 16/ to 18/ per cwt.; **Shoe heels**, York, No. 1, 3/5 to 3/8; No. 2, 4/ to 4/3; No. 3, 8/ to 8/9 per gross net; Dundee hot turned, 5/9 to 6/3; bright-edge imperial or solid Scotch, 9/6 to 10/; bright York 6 B, 8/ to 8/6; bright solid, 6/6 to 7/; toe plates, 9/6 to 10/ per gross. **Stair rods**, turned ends, 75 to 80%; solid fancy ends, 60 to 65%; cased tube, 30 to 35%; patent solid ornamental, 35 to 40%. **Sofa Springs**, coppered, 8 by 6 inches, 25/ to 27/ per gross; 9 by 7 in, 21/6 to 23/6; 7 by 7 inches, 17/6 to 19/6 per gross; galvanised **Waterloo Scoops and hods**, 1/6 per doz.; japanned Waterloo scoops and hods, 16 inch, 15/ to 16/; japanned scoops and hods, light, 16 inch, 15 to 16/ per doz.; **Shutter bars**, common spring, broad and double, 75 to 77½%; Scotch iron drop, 77½ to 80%; brass drop, 70 to 72½%; brass drop and catch, 67½ to 70%; registered brass spring box shutter bars, 52½ to 67½%; double-handed brass spring box, 57½ to 65%; **Saddlers' tools**, 5 to 10%; **Stocks and Dies** for smiths' use, 35 to 40%; ditto for engineers, 10 to 20%; **Steel toys**, 10 to 30%.

Traps, bowspring, sham Dorset and real Dorset rabbit traps, 45 to 65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 8/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 60%; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/9 to 4/9. **Tin plates, I C**, 25/ to 26/. **Tinmen's machines** and tools, 5%; brass **Bell Tube**, ½ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brased tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 65 to 67½%; fittings, 67½ to 70%; iron **Water Tubes**, 55 to 57½%; fittings, 60 to 62½%; iron **Steam Tubes**, 47½ to 52½%; fittings, 52½ to 57½%; galvanised iron gas Tubes, 50 to 52½%; fittings, 55 to 57½%; lap-welded **Boiler Tubes**, 52½ to 55%, delivered in London, Liverpool or Glasgow; table catches, 36 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Vices, common black, 30 to 32/ per cwt.; common bright, 38/ to 40/ per cwt.; black staples vices, solid box black, 33 to 40/; bright, 30/ to 45/; solid box, black staple, with spherical washer, 40/ to 45/; bright 45/ to 50/.

DIARY OF FORTHCOMING SALES.

NOTICES OF SALES OF ENGINES, PLANT, AND MACHINERY, IMPLEMENTS, MINES, AND COLLIERIES.

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ANGLES.		Manchester Office: 6 BOND STREET.					TEES.	CHANNELS.
8 × 4	3½ × 3½	3 × 3 = 10lbs.	5 × 3 = 13lbs.	7 × 2 = 14lbs.	9¼ × 3½ = 24lbs.	12 × 5 = 42lbs.	5 × 6	12 × 3
6 × 6	3 × 3	3 × 1½ = 5 ,,	5 × 4½ = 23 ,,	7 × 3½ = 20 ,,	9½ × 4½ = 29 ,,	12 × 6 = 56 ,,	4 × 4½	9½ × 3½
6 × 3½	2½ × 2½	4 × 1½ = 7 ,,	6 × 2 = 11 ,,	8 × 4 = 22 ,,	10 × 4½ = 32 ,,	14 × 6 = 60 ,,	5 × 3	9¼ × 3½
5 × 3½	2 × 2	4 × 3 = 12 ,,	6 × 3 = 16 ,,	8 × 5 = 29 ,,	10 × 5 = 36 ,,	16 × 6 = 62 ,,	3 × 3	8 × 3½
4 × 3	1½ × 1½	5 × 2 = 8 ,,	6 × 5 = 29 ,,	8 × 6 = 34 ,,	10 × 6 = 54 ,,	18 × 6¼ = 82 ,,	2½ × 2½	6 × 2½
4 × 4	1 × 1					19¼ × 7 = 100 ,,	2 × 2	4½ × 2¾
							1½ × 1½	2¾ × 1
							1 × 1	

JOISTS—Lengths, from 6 to 36 ft. PLATES—Width, 6" to 18"; Length, 12 to 30 ft.; Thickness, ¼" to ¾".

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COMMERCIAL.

ANNUAL REVIEW OF THE SHIPPING TRADE.

Messrs. Kellock and Co., brokers to the Admiralty, have issued the following review of the British Shipping Trade during 1879:—For the first time during the last four years we are enabled to congratulate our friends upon an existing cheerfulness in shipping circles, founded on a steady, solid improvement in business generally, and what may be not unreasonably considered a positive termination of that period of settled gloom and stagnation in trade all round, which, for a weary time, seemed to bar all hope of change for the better. During the first half of the year the demand for new tonnage continued to be exceedingly moderate, owing to the absence of remunerative freights; produce, notwithstanding cheap money, failed to find a ready market, and our exports diminished to an alarming extent, as the official returns continued to show. Early in the last half, however, the long-looked-for improvement came from the other side of the Atlantic, confidence begat confidence, and, with the influence of a healthy speculation, an almost imperceptible briskness came over us which was never more welcomed or needed. We do not pretend to go deeply into the causes of this in our limited space, being content to find it is now generally acknowledged; doubtless our trade, as carriers, owes very much to another of those harvests, which, ruinous to our farmers as a class, throw us unreservedly upon the resources of foreign States more highly favoured, and so bring into active circulation the gold, minerals, and manufactures of this country. Statistics show that the import of wheat from United States to Liverpool alone, for eleven months ending 30th November, amounted to the enormous total of 10,880 centals, the import of maize into Liverpool from American and Canadian ports in the same time being 10,582,000 centals, while the Continent absorbed a still further quantity of both wheat and maize, the wheat harvest of France, formerly a considerable exporter, being one-fourth less than the consumption of that country. This naturally withdrew from its regular trades a large proportion of our steam tonnage, for although our Continental competitors have considerably increased their steam fleets they have not yet replaced a tithe of their old sailing tonnage which formerly played so considerable a part in the grain carrying trade. In addition to the increased grain carrying must be noticed the satisfactory continuance of the Atlantic cattle traffic, which has remained fairly remunerative, though the rates have declined from those ruling last season; experience in the trade has decreased the losses and stimulated shipments until the weekly imports of live cattle *all the year round* are as regularly recorded to those of grain. The extraordinary diminution in recent years in the building of foreign-going ships in our Colonies and the United States, owing mainly to their costliness, has stimulated the building of and left ample room for, our splendid fleet of Iron sailing ships in long-voyage trades, and the fear that such tonnage must eventually be swept away by steam has very sensibly diminished. It is reported, on apparently good authority, that a Bill is about to be submitted to the American Senate authorising the alteration of the law so far as to permit the purchase of foreign-built, and especially of iron, vessels, under a moderate duty. Should this be carried, the effect on our market cannot be other than beneficial. The decrease in 1879 alone in the American tonnage employed in foreign trades was 137,514 tons. We give below some figures shewing the amount of steam and sailing tonnage built in 1878 and 1879, and we think these figures are principally interesting when taken in connection with the facts—first, that this country is and must for a long while yet continue to be the carrier of the world, and that, while we can without much labour estimate within a few thousand tons the quantity of work capable of being put out of our building-yards, we cannot, even with the aid of the most carefully prepared statistics, gauge the annual increase of the world's productiveness. The yearly loss of tonnage goes on much as ever as our annexed figures shew; old vessels disappear from service more rapidly than formerly, and the wear and tear on the shipping of the present day, made up as it is so largely of steamers is of necessity very great. Owing to the extreme severity of bad trade in 1878, it was not to be expected that shipbuilders could escape its effects, hence the building of steam tonnage shows a very marked falling off; iron fell to a price scarcely ever known, and, consequently, owners who were willing to contract did so on their own terms. First-class cargo boats have ruled at from £8 10s. to £10 10s. per ton on their dead-weight carrying, and many of our owners made such good investments in steam they are not likely to have the opportunity of repeating for some time to come. In October, however, the change came, and the improved demand for tonnage had an immediate effect on the iron market, causing prices of ship plates and angles to advance, in less than two months, fully 50s. to 60s. per ton. During this time a great number of boats were fixed, and the building yards will be busy for the next six months. Throughout the year the business in second-hand steamers has been very considerable, strong and economical boats finding ready sale at good prices, and the number of such vessels for sale is now very limited. The building of iron sailing ships in 1879 shows a still further decrease on that of 1878, and our figures under this head are singular; we have, however, recently placed a number of orders, and we can hardly wonder at owners being tempted to build splendid iron ships at £10 to £11 per ton register, when Calcutta freights advanced fully 300 per cent., and Australian, Californian, and West Coast rates correspondingly good; nor are these freights merely temporary, for there is every indication of Eastern rates especially being maintained for some months, the telegrams from Calcutta stating that the harvest promises to be a magnificent yield. Second-class iron sailing ships, though not forced upon the market in any number, gradually declined in value, until in October we were selling really good vessels as low as £5 per ton, and, in a few instances, even less; they have, however, felt the reaction, and we now quote an advance of fully £2 per ton, the demand still continuing. In our circular for 1878 we remarked on the probable future of steel in shipbuilding, and we are glad to record that several of our largest steamship companies have recently given orders for steel ships of considerable size, and their results will be watched with much interest; at present the difficulty in obtaining delivery of the steel, combined with the high price still demanded for it, tends to check the gradually growing feeling in favour of its use. We do not remember for years past a season which produced so few new colonial ships, and the reason is not far to seek, for the low prices brought by those we have had are but poor encouragement to the Canadian builders. The highest prices obtained this year for 11 years A ships was £6 5s. per ton. We have to note the sensible action of the managers of the Bureau Veritas in extending their classification to 13 years, from which the best results hoped. The supply of older wooden ships is rapidly are diminishing; the severe weather of the last two or three seasons has told its tale, and we apprehend an increasing difficulty in finding adequate tonnage for the timber trade, except at higher prices. An improved demand, and largely decreased stocks of timber, point to better wood freights in the spring.

CAST IRON PULLEYS.

As shown below or in halves, made any diameter or width.

TAYLOR & CHALLEN,

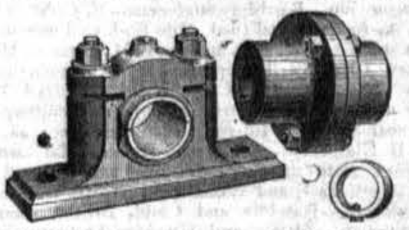
DERWENT FOUNDRY,

BIRMINGHAM.

For each extra 1 inch in width add 10 per cent. to following prices:

LEADING SIZES AND PRICES, TURNED AND BORED.

Diameter in inches	6	8	10	12	15	18	21	24	27	32	36	42	48	54	60
Width, ditto ..	2	2	2	3	3	3	3	4	4	4	5	5	5	6	6
Price, Split, shillings ...	8	9	10	11	14	17	20	25	32	38	46	55	66	95	110
Do. Plain do....	5	6	7	8	10	13	16	20	25	30	38	45	55	80	90



Plummer Blocks, with brasses and bolts, planed, bored, &c Couplings, bored, faced, keywayed, and with turned bolts. Loose Collars of wrought iron bored, turned, and steel screws.

STOCK, SIZES, and PRICES, delivered here.

Bore, in inches to standard	1¼	1½	1¾	2	2¼	2½	2¾	3
PLUMMER BLOCK, ...each	6/	7/	8/	10/	12/	16/	21	27/
COUPLINGS ....pair	7/	8/	10/	13/	17/	22	28	35/
LOOSE COLLARS...........each	2/2	2/6	3/	3/6	4/	4/6	5	6/
SHAFTING, sup. qual. foot	1/3	1/7	2/1	2/6	3/3	4	4/9	5/8

SUMMARY.

IRON VESSELS BUILT IN THE UNITED KINGDOM IN 1878—1879.

	No.		Gross tonnage.		Net tonnage.
1878 ..	388	..	500,485	..	323,593
1879 ..	284	..	415,881	..	273,246
Decrease	104	..	84,604	..	50,347

Total number of steamers built in 1878 and 1879.

	No.		Gross tonnage.		Net tonnage.
1878 ..	388	..	500,485	..	323,593
1879 ..	284	..	415,881	..	273,246
	672	..	916,366	..	596,839
On foreign account	64	..	89,971	..	59,800
Total British	608	..	826,395	..	537,039

SAILING SHIPS.

	No.	Net Tonnage.
1878	90	92,216
1896	25	25,133
Decrease ..	65	67,083

AVERAGE TONNAGE OF SAILING SHIPS.

		Tonnage.
Average Registered tons per Ship in 1878	..	1,025
Ditto. ditto. 1879	..	1,000

DISTRIBUTION OF TONNAGE.

The Sailing Tonnage built was distributed as follows:—

	1878.		1879.	
Tons.	Vessels.	Tons.	Vessels.	Tons.
Under 750	19	4,730	9	3,067
750 and ,, 1,000	19	13,753	1	866
1,000 ,, ,, 1,500	35	42,995	9	11,127
1,500 ,, upwards	17	28,738	6	10,073
	90	92,216	25	25,133

VESSELS LOST, &c.

SAILING VESSELS OF ALL NATIONS.

1878	1394
1879	1592
Total	2986

	1878.	1879.
Of these there were under the English Flag	502	565
" " American "	236	247
" " German "	101	127
" " French "	143	136
" " Nor. and Danish "	117	125

The remainder being Dutch, Austrian, Italian, Spanish, &c.

STEAMERS OF ALL NATIONS.

	1878.	1879.
Lost	141	164
Of these there were under the English Flag	91	111
" " " Other "	50	53

The numbers for November and December, 1879, both of sailing and steam vessels lost, are estimate *pro rata* with those of the same months in 1878; the losses of steamers in those months in 1879, when actually ascertained, will, however, be found to be largely in excess of any ordinary average, and would appear to be altogether exceptional; these figures have been compiled as carefully as possible, so as to arrive at the *actual losses*, apart from mere casualties.

From carefully-prepared returns we are enabled to state that the orders for new tonnage, to be built under the special survey of Lloyd's and the Liverpool Underwriters' Registry, given out during the months of October, November, and December, amount to 140 vessels, of the aggregate of 190,000 tons.

PARTNERSHIPS DISSOLVED.

T. Crook and J. Foster, Preston, Lancashire, bolt manufacturers.—E. Cockburn, jun., and C. J. Jutson, Shepherd's-bush Coal Depot, Uxbridge-road Station, coal merchants.—W. Roser, W. Hawes, and C. Welsh, Cleygate, Surrey, brickmakers.—T. Dent and J. Whitehead, Nelson, Lancashire, brickmakers.—E. Turner and W. Olsen, Birmingham, hook and eye manufacturers.—W. W. Hutchinson and J. Hutchinson, jun., Barnsley, engineers.—F. C. W. Claydon and W. A. Baker, Canal-road, Mile End, coal merchants.—Jackson and Co., Barbican, and as H. M. Capner, Myddleton-street, Clerkenwell, importers and manufacturers of scientific apparatus.—Old Change and Standard Works, London and Dundee.—Morriston Tinplate Company, Morriston, near Swansea, tin-plate manufacturers; as far as regards D. Glasbrook.—Jones and Roberts, Talysarn, Carnarvonshire, slate shippers.—Andrew and Turner, Commercial Street, East, and White Lion Street, Whitechapel, mill furnishers.—Ratcliffe and Child, Bristol, steam saw mill proprietors.—M'Kay and Knowles, Oswestry, mechanical engineers.—Brawn and Downing, Birmingham, architectural metal workers.—W. Nelson and J. Fraser (under the style of J. Fraser), Stockton-on-Tees, hotel keepers.—Vaughan and Stubbs, Manchester and Lincoln, patentees of the self-acting water ejector.—Roberts and Johnson, Bow, Stratford, and Bishopsgate Street Within, City, wharfingers.

THE DUSSELDORF EXHIBITION OF 1880.—The extensive structure in which the important exhibition of next year is to be held at Düsseldorf, is now, as far as the walls and roofing are concerned, complete. The length of the main building is 1181 feet, and the area it covers is almost exactly equal to that of the Exhibition Palace at Sydney, New South Wales, or about half the length of the great exhibition building at Paris in 1878. Such being its proportions, the Düsseldorf Exhibition, with its towers and cupolas, presents even at a distance an imposing spectacle. The workmen are now busily engaged on the division and fitting up of the interior, and no doubt is entertained that the whole will be in perfect readiness for the opening day, which has been fixed for the 9th of May, 1880. The total number of exhibitors in the industrial portion, reckoning the numerous collective exhibitions as only one, will amount to upwards of 3000, and every branch of German industry, manufactures, and commerce will be represented at the show. Many of the principal firms are erecting special buildings or annexes of their own. In addition to these 3000 exhibitors connected with industries, there will be three other divisions devoted respectively to fine art, agriculture, and forest structure. The fine art department, which will occupy part of the main building, will be a universal exhibition of German painting and sculpture. In the agricultural division there will be no less than 85 exhibitors of agricultural machinery alone. One of the most useful departments of the show will be that of forest culture, which is a novelty at an exhibition of this kind, and as Germany is noted as the head-quarters for the scientific study and practical acquisition of this branch of culture, much interest will attach to the maiden exhibition of this branch of field industry at Düsseldorf. The agricultural and forestry exhibition will be held in a number of annexes attached to the building. Krupp, of Essen, is building an extensive special pavilion, which is nearly complete, and in which he will exhibit some of his latest novelties in iron and cast steel, including an extensive show of his latest cannon, large and small. Another annexe will be occupied by the publisher of the *Cologne Gazette*, who will show the latest improvements in newspaper printing in Germany. The exhibition committee have resolved to issue a newspaper, to be called the *Exhibition Gazette*, for the duration of the show, and this will be printed and published in the building. The committee are likewise making extensive preparations for the refreshment department, as well as for the cheap lodging, entertainment, and amusement of visitors from a distance.

PERILS OF FISHERMEN.—A report carefully prepared at Gloucester, Massachusetts, states that the loss of life among the fishermen from that port in 1879 has been unprecedented. In all 30 vessels, aggregating 1980 tons, comprising over a tenth of fishing tonnage of the port, and valued at 118,789 dols., all of which were insured on the mutual system for 95,185 dols., sailed to return no more, and 240 lives have been lost, leaving 88 widows and 219 fatherless children. Since 1830, when the George's fishery commenced, there have been lost from this port 2118 men, and 405 ships, valued at 1,696,399 dols.

ANDREW AND JAMES STEWART,
OFFICES: 41, OSWALD STREET, GLASGOW.
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WROUGHT IRON WELDED TUBES AND FITTINGS,
Borings and Artesian Tubes, Perkins' Hot Water Tubes, Tubes closed at one end for Field Boilers, and all other descriptions of Tubing.
LOCOMOTIVE IRON AND STEEL TUBES
OF VERY SUPERIOR QUALITY.
PRICES ON APPLICATION. CAST IRON PIPES.

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Ship-Boiler Girder Rivets, Railway Spikes, Screws, Screw Bolts, Nuts,
BEST MATERIALS AND WORKMANSHIP. MODERATE PRICES.
PROMPT DELIVERIES OF ALL HOME AND EXPORT ORDERS.

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B. M. RENTON,
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HAS ALWAYS A LARGE STOCK OF
BESSEMER RAIL ENDS
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OLD BESSEMER DH RAILS
For Sale in all parts of the country, also Bessemer Billets and Blooms of any size and for all purposes, Old Steel Tyres, either whole or broken, Old Springs, Old Files, Cut Bessemer Scrap and Spring Ends for remelting, English and German Spiegeleisen, Swedish and Russian Steel Iron and Box Ends, Swedish Nail Rods and Bundling Iron.

PARIS, 1878, Class 67, SILVER MEDAL, the only medal awarded.

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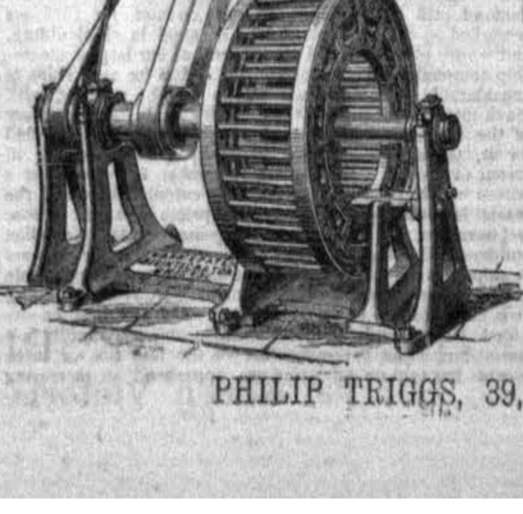
CHADBURN & SON'S
PATENT REPLY
ENGINE & STEERING
ENDLESS BAND
TELEGRAPHS.
FITTED ON BOARD VESSELS OF
THE ENGLISH, GERMAN, AUSTRIAN, BRAZILIAN, AND TURKISH NAVIES.
ROYAL MAIL STEAM SHIP COMPANIES.
OFFICE & SHOW ROOM.
71 & 73, LORD STREET.
STEAM FACTORY.
11, WATERLOO ROAD.
REPAIRING STEAM GAUGES.
LIVERPOOL,
LONDON:—96, FENCHURCH ST.
GLASGOW: 2, TAYLOR PLACE, GOVAN ROAD. NEWCASTLE: 40, BLENHEIM STREET.

Awarded Bronze Medal, Paris Universal Exhibition, 1878.
REVISION OF PRICES. ABOLITION OF ANNUAL LICENSE CHARGE.
CARR'S PATENT DISINTEGRATOR.

This Machine effectually pulverises by the combined influences of percussion and of centrifugal force, Iron, Zinc, and other Ores, Asphalte, Artificial Manures, Phosphates, Fire Clay and many other substances. It is also largely in use for the pulverisation of coal for the manufacture of Coke, Patent Fuel, &c.; and is very effective for mixing Sugar.

These Machines are capable of reducing to a fine granular powder from 50 to 200 tons per day (according to size) of any unfibrous material. Machines made to order from 18 inches diameter, to suit special requirements of purchasers; these small machines being specially adapted to the requirements of Chemical Manufacturers for Mixing and other purposes.

A Description Pamphlet will be sent free on application to the Managing Trustee of the Estate of the late Patentee,
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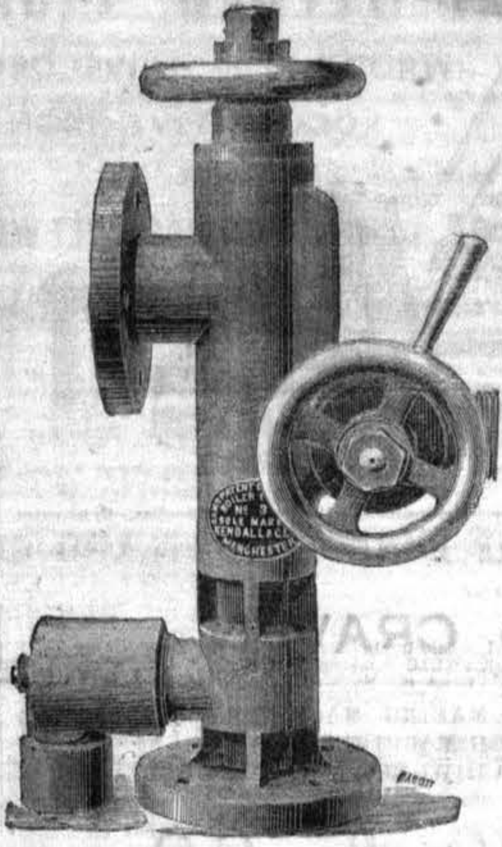
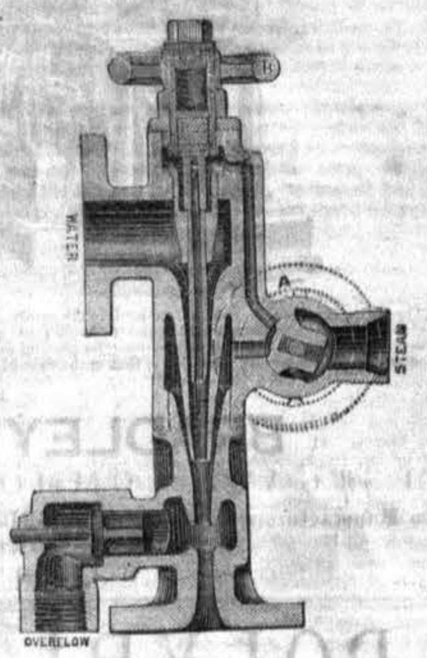
Has no stuffing boxes or joints entailing constant renewal of packings.

Can be examined internally throughout without removal or disconnection of a single joint.

So simple and easy to work that any unskilled person can put it in operation; indeed, in this respect, as well as certainty to continue in action without further attention until stopped, it is unequalled.





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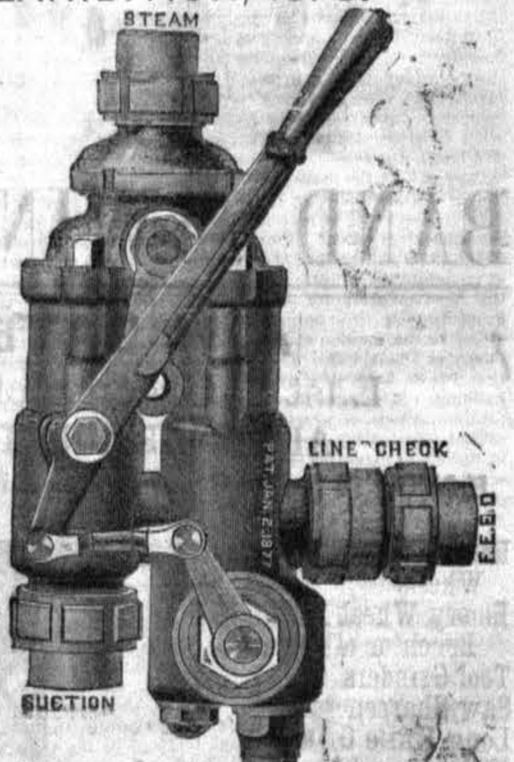

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Traction and Portable Engines are not perfect without them. It lifts its water 25 feet with a low steam pressure, and puts it directly into the Boiler. No adjustment necessary for varying steam-pressures.

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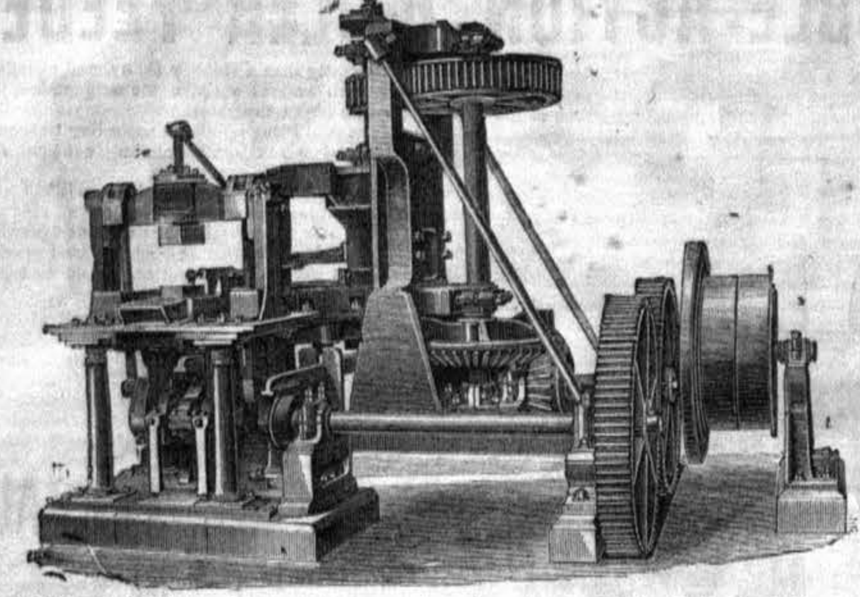

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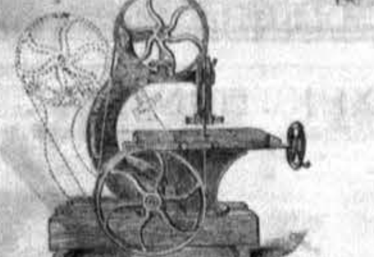

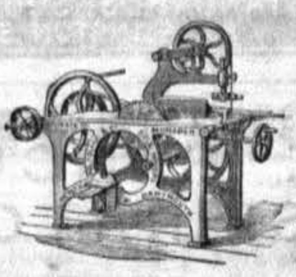

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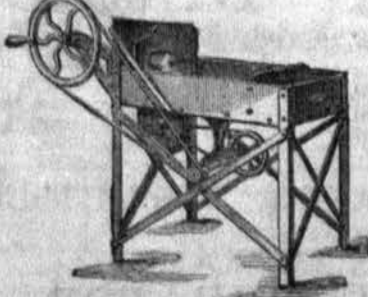

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Capable of producing 1500 *feet of Thatch per hour.*

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Beg to call attention to their superior made Iron and Steel WIRE Ropes, for Colliery and Railway purposes; also for Capstans, Guide Ropes, Suspension Bridges, &c.

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ARTESIAN WELLS bored STRAIGHT and TRUE—Large and small diameters—Easy to line and put down Pumps—Tenders given for Wells, Pumping Machinery, and Engines, complete.

PROSPECTING FOR MINERALS to any depth—The only system by which a true section of the strata can be obtained from the cylindrical cores taken out.

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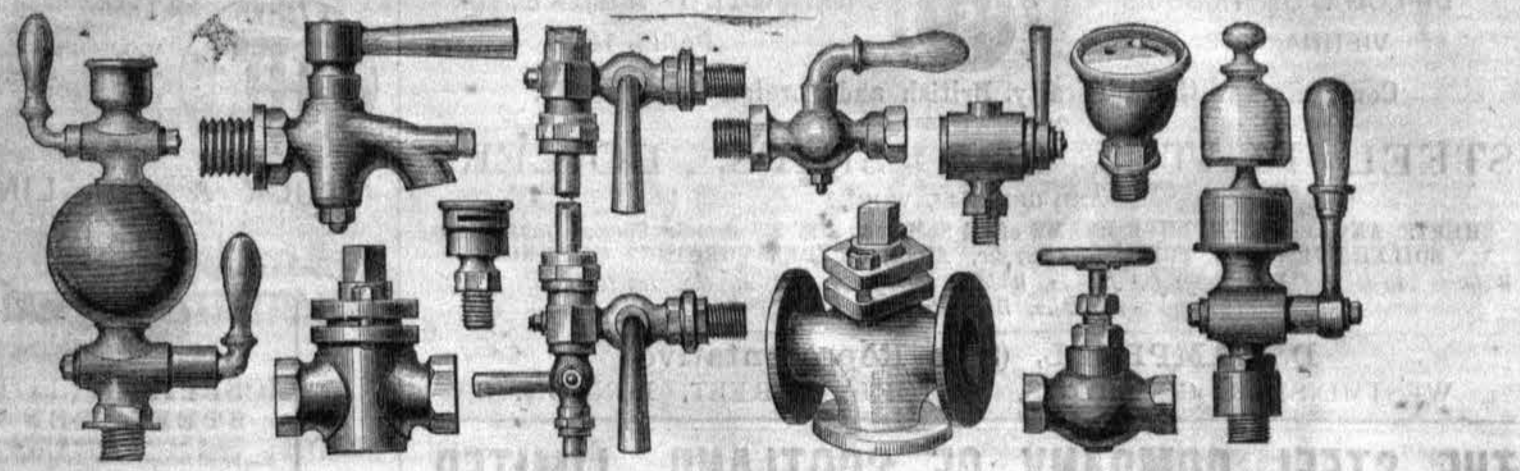

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Illustrations of a Large Variety of Patterns, with Price List, may be had on Application.

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Was also conferred upon Mr. JOSEPH RUSTON in special appreciation of the Merits of the Machinery exhibited by his Firm.

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Various Sizes of Burners and Globes.—Plain and Ornamental.

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Beware of inferior Imitations.

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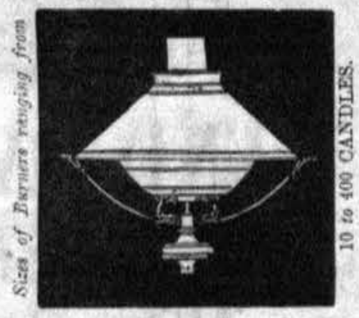

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PRICE £140.
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SINGLE-HANDED STEAM LAUNCHES 20 FT. LONG FROM £80.—LAUNCH ENGINES AND BOILERS.
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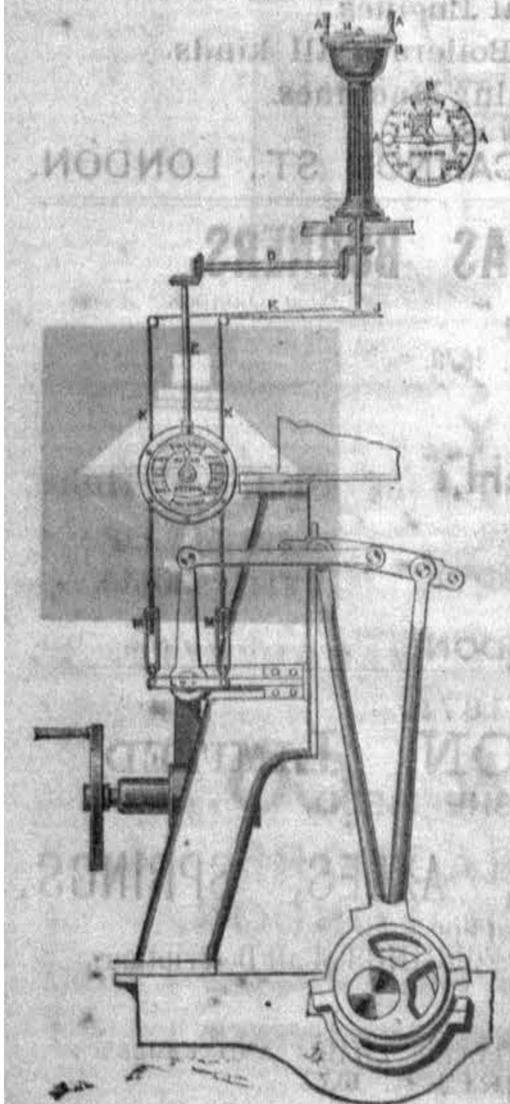

This is the only BRIDGE TELEGRAPH in which the Engine itself replies to the Captain's orders.

By Royal Letters Patent.

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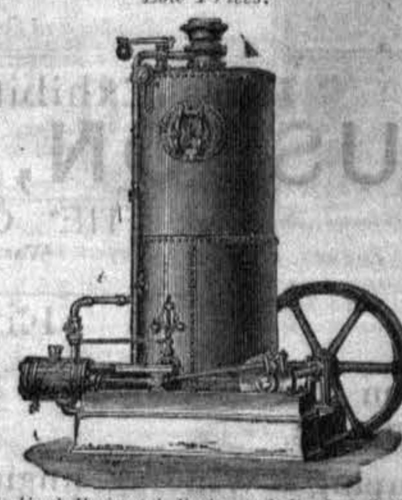

Combined Horizontal Engine and Vertical Boiler.

Nominal Horse Power ...	2	3	4	6	8	10	14
Diameter of Cylinders.—Ins.	4½	5½	6½	8½	9½	10½	17
Price	£60	78	98	130	156	198	230

Full descriptive Price Lists of Engines, with or without Boilers on Application.

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Fanblowers and Exhausters.
ALL SIZES IN STOCK.
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All kinds of Crude and Manufactured Asbestos kept in Stock.

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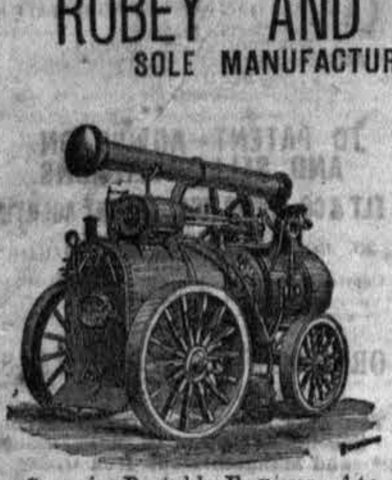
References can be given to upwards of 5600 Engines of all sizes now at work.



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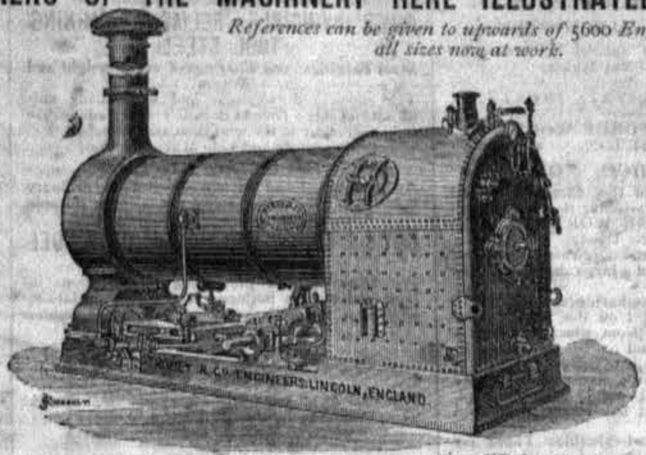

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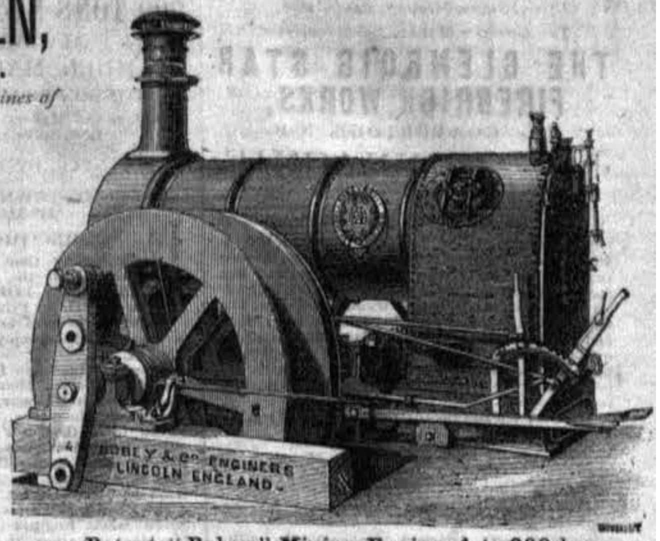

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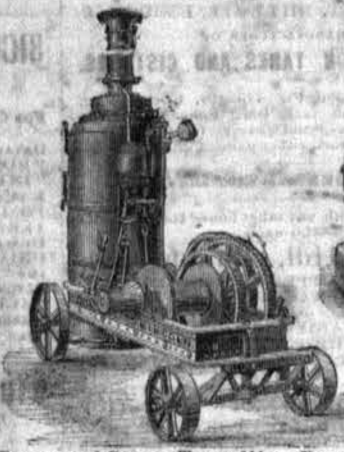

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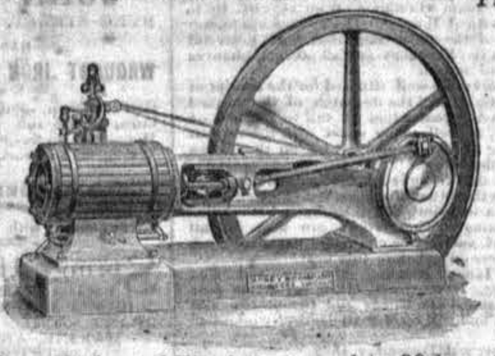

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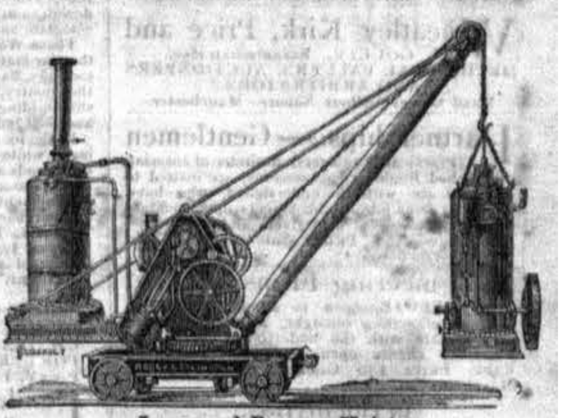

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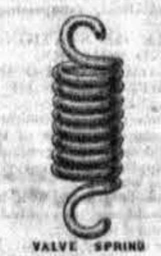
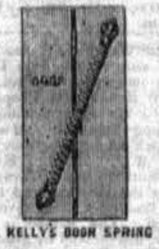


VALVE SPRING

LOOSE HANDLED SAD



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PATENTS OBTAINED AND MANUFACTURERS' DESIGNS AND TRADE MARKS REGISTERED.
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To be Sold, by Private TREATY, as a going concern, on the Great Northern line of Railway, a well-established ENGINEERING BUSINESS, comprising the following branches, viz.:—
THE MANUFACTURE OF STATIONARY ENGINES AND BOILERS.
PORTABLE AND COMBINED DO. DO.
AGRICULTURAL IMPLEMENTS OF ALL CLASSES.

And specially the manufacture of wrought-iron cranks, for which a complete plant of Patent Machinery has been put down; also general Iron Foundry, with all the appliances for carrying on and extending a first-class trade.

The Machinery and Tools are by well-known makers, and the new buildings are erected upon lands secured on a 999 years' lease.

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Northamptonshire.—The Woodford House Estate, for many years the seat of the late General Arbuthnot, a highly important Freehold (and small part leasehold) Residential Property of upwards of about 750 acres, possessing great mineral value, adjoining Twywell, and within a mile of Cranford, both having stations on the Huntingdon branch of the Midland Railway, three miles from the market town of Thrapstone, which has stations on the Midland and London and North-Western Railways, and seven miles from Wellingborough. The estate is of an undulating character, intersected by good roads. It includes a family residence occupying a pleasing site, overlooking a timbered park, surrounded with well-grown plantations, interspersed by walks, tastefully-arranged pleasure grounds, capital walled kitchen garden, greenhouses, stabling, small farmery, &c. There are two good farmhouses, with suitable homesteads; also accommodation land and cottages in the thriving village of Woodford. Some of the richest beds of iron ore and limestone underlie the greater portion of the estate, parts of which are now being worked, and it is believed there is no district where these minerals can be found under more favourable circumstances, or put into the market at a cheaper rate. There are private rails and tramways on the property connecting it with the Midland Railway by sidings at Twywell.

Messrs. Farebrother, Ellis, CLARK, & CO., are instructed to offer the above valuable ESTATE for SALE by AUCTION, at the Mart, Tokenhouse Yard, London, on WEDNESDAY, 28th January, 1880, at 2 o'clock, in lots. Particulars, with plans and conditions of sale, may shortly be obtained of Messrs. Walters, Deverell, and Walters, solicitors, 9, New Square, Lincoln's Inn, W.C.; Messrs. Hemsley and Hemsley, solicitors, 5, Albany Court Yard, Piccadilly, W.; Messrs. Farrer, Ouvry, and Co., solicitors, 66, Lincoln's Inn Fields, W.C. Messrs. Green and Cheese, solicitors, 2 Warwick Street, Charing Cross, S.W.; of Messrs. Langbourne, Langbourne, and Stevens, solicitors, 7, Lincoln's Inn Fields, W.C.; of Mr. S. Prickett, at the Ironworks office on the estate; at the Mart; and, with orders to view, of T. H. Burroughes, Esq., No. 30, Lincoln's Inn Fields, W.C.; and of Messrs. Farebrother, Ellis, Clark and Co., 5 and 6, Lancaster Place, Strand, W.C.; and 18, Old Broad Street, London, E.C.

King's College, London.— METALLURGY by PROFESSOR HUNTINGTON. New Classes in this subject (established by help of the City Guilds) will begin on THURSDAY, January 15th.—For particulars, apply to J. W. Cunningham.

Locomotive Tank Engines of all sizes and for all gauges. Several in stock and in progress.—Fletcher, Jennings and Co., Lowca Engine Works, Whitehaven.

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200 TONS NUTS, BOLTS, &c.,

ALWAYS IN STOCK.
SAMUEL MARSDEN & SON.
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Patentees and Makers of Special Machinery for Bolt, Spike and Nut Making.

FOR SALE, BY PRIVATE TREATY.

DENNYSTOWN FORGE WORKS. DUMBARTON.

In consequence of the effluxion by time of the Copartnery, and Death of one of the Partners, the well-known DENNYSTOWN FORGE WORKS, Dumbarton, are for Sale by Private Treaty.

These Works have been established upwards of 26 years, and have enjoyed a large share of public support.

They are situated in Dumbarton, on the bank of the River Leven, bounded on the East by the North British Railway, (from which there is a branch into the works), and on the West by the Leven, where there is a private quay.

The Ground extends to 4 Acres 19 Poles, or thereby, at the moderate Feu-duty of £52 8s. 4d. The value of the ground has largely increased since the date of the feu.

The Plant is extensive and valuable. There are Seven Steam Engines (large and small), Sixteen Machines in Lathes, Slotters, Screwing Machines, &c.; Nine Steam Hammers, from 15 cwt. to 10 tons; 18 Vertical Boilers. The Cranes are numerous, and of the most improved and powerful description, the Furnaces and all other appliances complete and ample.

These Works are well situated for the receipt of the raw material and the despatch of the finished forgings, having connection by rail to all parts of the country, as well as by water with the various shipbuilding and engineering yards on the Leven and the Clyde.

In the locality there is a large demand for forgings; while the situation of the Works at all times commands a superior class of workmen both skilled and labouring. The Works are now in full employment, and will be continued so for the entry of a purchaser on or before July next.

Messrs. James Ritchie, Maclean and Co., Writers, 175, Hope-street, Glasgow, are in possession of the Title Deeds and Inventories and Valuations, and will furnish all necessary information.

Glasgow, 30th December, 1879.

CONTRACT FOR STEEL TRAM RAILS, CHAIRS AND FASTENINGS FOR THE PORT ELIZABETH TRAMWAY COMPANY, LIMITED.

Tenders are invited from such persons as are willing to supply the following MATERIALS required for the CONSTRUCTION of the Port Elizabeth TRAMWAY, Cape of Good Hope, viz.,

2150 Centre groove Steel Rails, about 300 tons.
21,500 Cotter Bolts and Nuts.
30,300 Split Cotters.
7525 Tie Bars.
15,050 Cast Iron Chairs, about 300 tons.

Tenders will be received for the whole, or for the Rails, Fastenings and Chairs separately, and must be sent in not later than SATURDAY, 17th January next, addressed to Robt. Stewart, Esq., Chief Manager Standard Bank of British South Africa, 10, Clements Lane, Lombard Street, London, E.C., marked on cover "Tender for Port Elizabeth Tramway."

Specifications, Drawings and Forms of Tender can be obtained from the Company's Inspecting Engineer, J. H. Greathead, Esq., 8, Victoria Chambers, Westminster; or from the Company's Agents, Messrs. Filby and Kemp, 2, St. Michael's House, Cornhill, E.C. The Agents do not bind themselves to accept the lowest or any Tender.

31st December, 1879.

TO ENGINEERS, &c.

This Corporation being de- SIROUS of receiving TENDERS for the Construction and Delivery, at Trinity Wharf, Blackwall, of 200 WROUGHT-IRON OIL DRUMS, of 5 Gallons each, Notice is hereby given, that the Specifications and Forms of Tender may be obtained on application at the Store Department at this House, on any day between the hours of 10 a.m. and 4 p.m. Tenders sealed and marked outside "Tender for Oil-Drum," must be addressed to the Secretary, and delivered at this House on THURSDAY, the 8th inst., and no Tender can be entertained that is not made on the form provided.

The Corporation does not pledge itself to accept the lowest or any tender.

By Order,
ROBIN ALLEN, Secretary.
Trinity House, London, 1st January, 1880.

Eastern and South African Telegraph Company (Limited).—This Company's line being completed throughout, TELEGRAMS are accepted for transmission to Zanzibar, Mozambique, Delagoa Bay, and Durban, for NATAL, Transvaal, Orange Free States, and the CAPE COLONY.

Telegrams should be sent from the Company's No. 11, Old Broad-street, 8, Leadenhall-street, and 3, Great Tower-street, London; 20, Brown-street, Manchester, and 2A, Exchange, Liverpool.

Telegrams sent from postal stations should be directed "via Eastern," these words being signalled free of charge.—By order,

GEORGE DRAPER, Secretary.
11, Old Broad-street, London, E.C.
20th December, 1879.

A Vacancy occurs in the office of a Naval Architect and Engineer in practice in Westminster, for an Articled Pupil. A moderate premium will be taken. Apply by letter, to A. E., care of Housekeeper, 6, Westminster-chambers, Victoria-street, S.W.

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Inventors should read "How to MAKE MONEY by PATENTS."—The "Engineer" wrote:—"We recommend it as a vade mecum for inventors." Free 14 stamps.—Barlow and Co., 23, Southampton Buildings, W.C.

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STEEL CONVERTERS AND REFINERS.
Sole proprietors and manufacturers of

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Steel Forgings and Castings of every weight and Section.

The unequalled excellence and undeviating uniformity of these famous Brands secure an immense economy in the workshop and the mine.

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An economical and efficient substitute for ordinary brass and gun metal, being much more durable and cheaper than these materials.

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Full descriptive price Lists on application.

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Cattle, Sheep, and Pig Troughs, Cart Bodies, Corn, Flour, and Sack Bins, Funnels, Shoots, Hoppers, Boilers, and every Description of Wrought Iron work either painted or galvanized.

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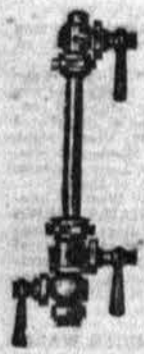

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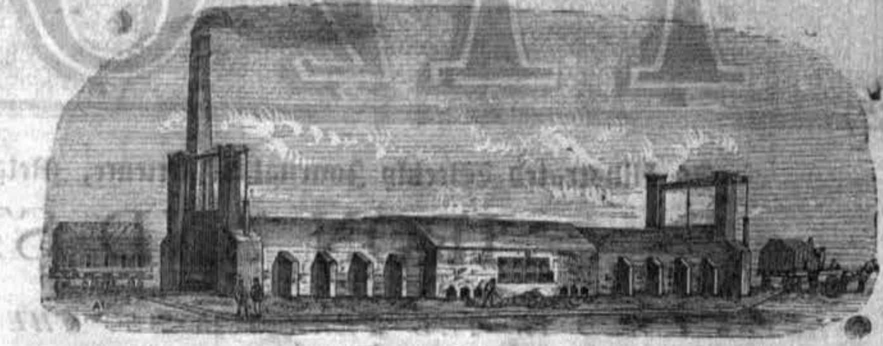

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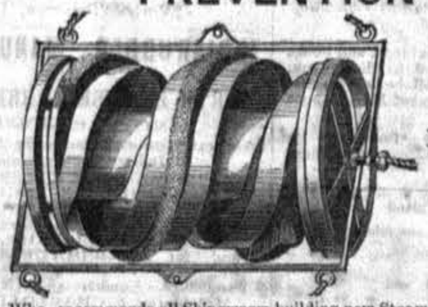

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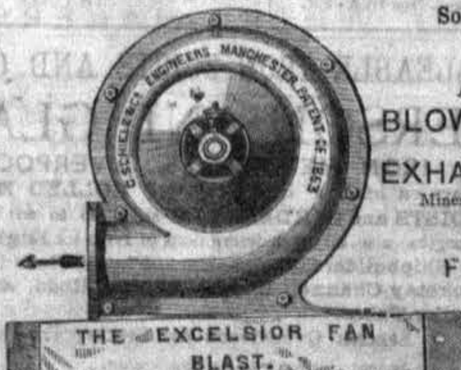
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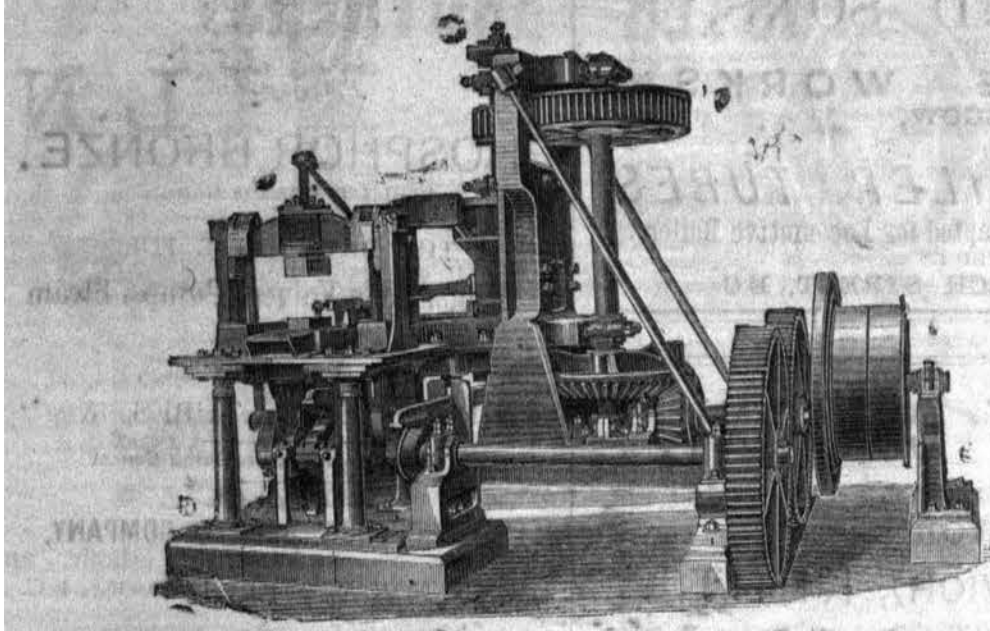

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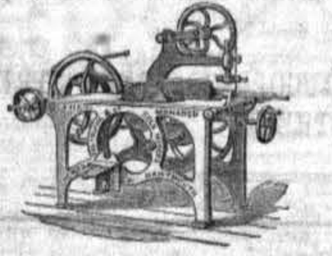

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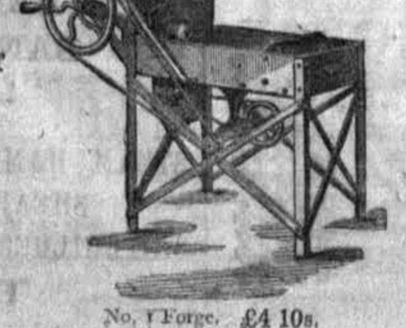

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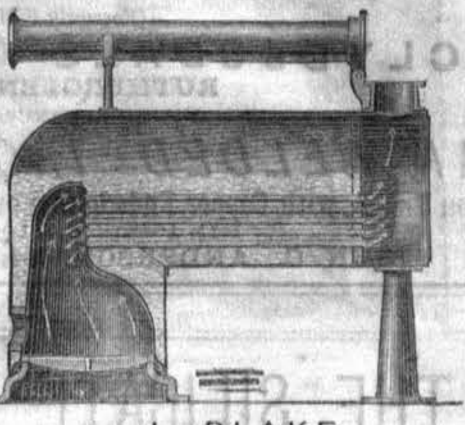

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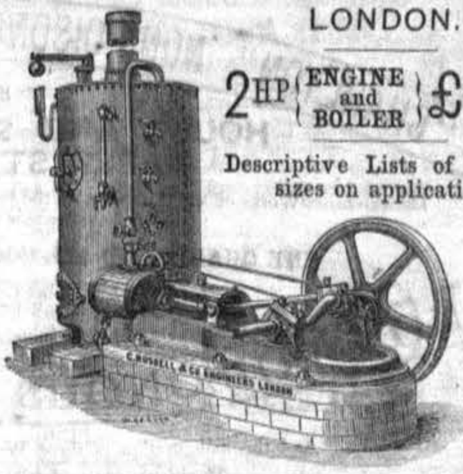

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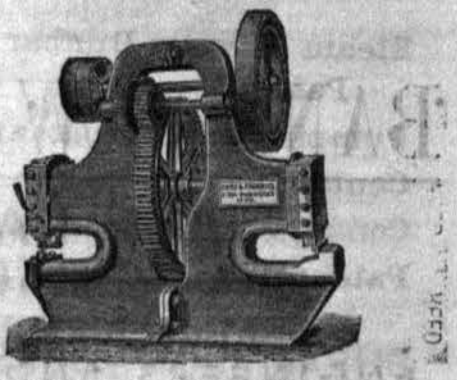

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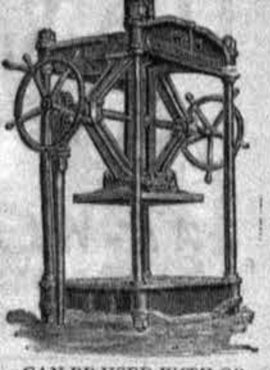

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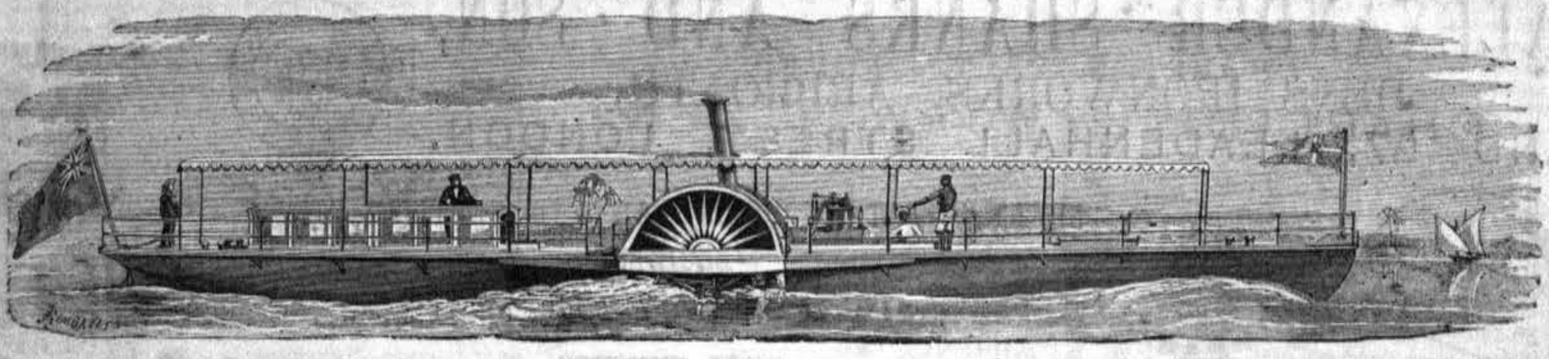

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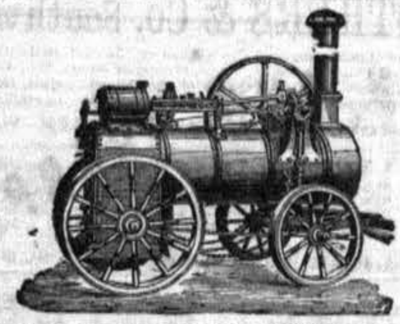

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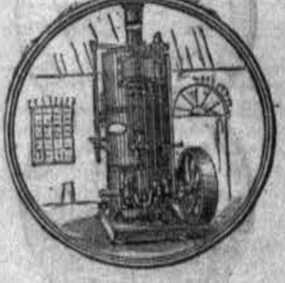

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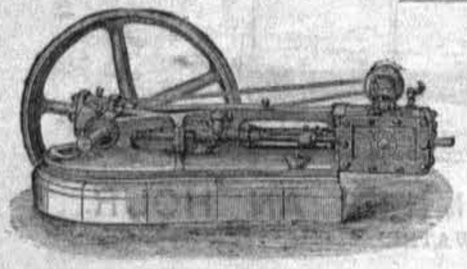

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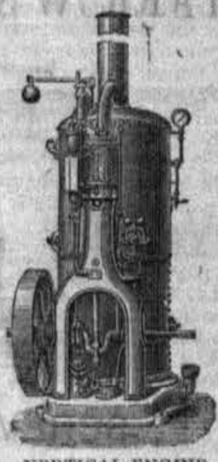

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6 × 3½	2½ × 2½	4 × 1½ = 7 „	6 × 2 = 11 „	8 × 4 = 22 „	10 × 4½ = 32 „	14 × 6 = 60 „	5 × 3	9¼ × 3¼
5 × 3½	2 × 2	4 × 3 = 12 „	6 × 3 = 16 „	8 × 5 = 29 „	10 × 5 = 36 „	16 × 6 = 62 „	3 × 3	8 × 3½
4 × 3	1½ × 1½	5 × 2 = 8 „	6 × 5 = 29 „	8 × 6 = 34 „	10 × 6 = 54 „	18 × 6¾ = 82 „	2½ × 2½	6 × 2½
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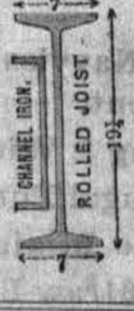

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IRON.

LONDON, FRIDAY, JANUARY 9, 1880.

THE EDISON ELECTRIC LIGHT.

IN summarising the scientific progress of the past year last week, we referred to the frequent promises Mr. Edison had made to the world, and the equally frequent disappointments he had caused it, with respect to the production of a system of electric-lighting, which was to extinguish all other systems, and to lead to the abolition of gas manufacture. We also gave the substance of a telegram which had been received in London to the effect that the time of fruition had arrived, and that his system was now perfected and about to be applied in practice. By the way, his electric-lighting developments have all hitherto reached this precise stage of being "about to be applied in practice." Since our article appeared, the American mail has arrived, bringing with it some particulars of this most recent outcome of Mr. Edison's ingenuity. According to the *New York Herald*, in the new system a piece of Bristol cardboard is cut into strips in the form of miniature horseshoes, about two inches long and one-eighth wide. A number of these strips are placed in a wrought-iron mould, separated from each other by tissue paper. The mould is placed in an oven, where it is gradually exposed to a temperature of about 600° Fahrenheit, so as to allow the volatile portions of the paper to pass away. The mould is then removed to a furnace, kept there till it attains almost a white heat, and is subsequently allowed gradually to cool down. The charred remains of the cardboard are taken out with great care, in order to prevent them from falling to pieces. They are placed in a small globe and attached to the wires connected with the generating machine. The next thing is to extract the air, by means of the pump, from the globe; that being accomplished, the globe is sealed, and the lamp is ready for use. The new lamp requires no complex regulating apparatus, such as characterised the earlier efforts. In fact, Mr. Edison finds that all previous labour in regard to regulators was practically wasted, and furthermore, that electricity can be regulated with absolute reliability in a manner precisely similar to that in which the pressure of gas is now produced. The system now adopted by Mr. Edison in connecting the wires admits of a given number of lights being extinguished without affecting hose of other burners, in the same way that we should shut a certain number of gas-burners and permit others to draw a supply from the meter the electric light can be obtained or shut out. The wires leading to the generating machine may be run through ordinary existing gas pipes to a central station at a distance of, say, half a mile. The only change really necessary in the present arrangements would apparently consist in unscrewing the gas-jet and replacing it with an electric lamp of Mr. Edison's construction. The probabilities are that for the purpose of lighting a city it will be necessary to establish a given number of stations, these stations to be distributed in such a manner that each of them could supply a district covering an area of about one-half or a third of a mile. At each station there would be one or two engines of great power to drive generating machines, each capable of feeding 50 lamps.

The generating machine, which Mr. Edison terms the Faradaic machine, is briefly described thus:—Two upright iron columns, 3 feet in height and 8 inches in diameter, covered with coarse wire and resting upon a base, form the magnetic poles. Fixed on an angle, so as to admit a free revolution between the poles, is a cylindrical armature of wood, wound parallel to its axes with fine iron wire. This cylinder is made to revolve rapidly between the magnetic poles, and by means of a belt, driven by an engine, strong currents of electricity are generated in the wire surrounding the armature, and these currents are carried along the wires to the electric lamps. In addition to the uses for lighting, the electric motor is capable of performing other work, such, for instance as running sewing machines. It requires no more electricity than is necessary to give out but one electric light of the strength of a common gas-jet. There are other uses for the motor, which, however, involve a technical knowledge of the laws of electricity. For measuring the electricity used by each consumer an electrolytic cell and a small coil of wire are placed in a box of about half the size of a common gas-meter, and kept in a convenient corner, similar to where the meter is placed at present. The measurement is obtained by collecting, on small plates, the copper particles which deposit in the electrolytic cell, such deposit being caused by the electric current passing through the cell. At given periods —say once a month—these deposits are weighed, and by a simple rule of calculation the amount of electricity consumed is ascertained.

Mr. Edison's chronicler states of him that he felt convinced some time ago that all serious obstacles towards success in obtaining incandescent electric lighting had been overcome; but the present discovery has tended to materially change the system in perfecting the electric lamp. Platinum had been brought up as a substance for illuminating power from a state of comparative worthlessness to one well-nigh perfection. Improvements had been obtained in air-pumps, obtaining a vacuum of nearly one millionth of an atmosphere. The magneto-electric machine had been perfected so as to give out some 90 per cent., in electricity, of the energy it received from the driving engine. Accidentally, Mr. Edison was induced to test the carbon remains of cotton thread. Placing the slender filament in a globe, and connecting it with the wires leading to the generating machine, he was gratified by the production of a beautiful light. Turning on a stronger and stronger current, the tender thread remained entire, till, finally, the maximum power of the machine was turned on. For a minute or more the tender thread seemed to struggle with the intense heat—heat that would melt a diamond—till at last it succumbed, and all was darkness The powerful current had broken it, but not before it had emitted a light equal to that of several gas-jets. Examined under a microscope, the curious filament, apparently so delicate, proved in reality more infusible than platinum, so long considered one of the most infusible of metals. Mr. Edison kept up his experiments; from carbonising pieces of thread, he turned to splinters of wood, straw, paper, and many other substances never used before for the purpose. The results have had the tendency to show, as stated above, that the substance best adapted for carbonisation and the giving out of an incandescent light has proved to be paper.

So far Mr. Edison and the chronicler of his discoveries. Let us now turn to the practical view of the matter as afforded by one who has an extensive experience of the subject, and whose labours in electric telegraphy are well known. We refer to Sir Charles Bright, who has addressed a letter to *The Times* in reference to Mr. Edison's latest reported production. Sir Charles observes that Mr. Edison's new inventions are virtually an abandonment of all his former ideas of electric light appliances which were announced about twelve months since with much profession of finality as regards practical success, and of immediate readiness for general use. Some mystery was then made about the real nature of the discoveries, but patent specifications are printed with tolerable promptness nowadays, and there is no secret at present as to the real character of Mr. Edison's inventions at the end of 1878, when they caused a great scare among gas-shareholders. They proved, on coming to daylight, to be simple reproductions of the work of former experimenters, of whose labours he was no doubt ignorant, dating from nearly forty years ago. Every kind of metal rendered incandescent by electricity was tried. Platinum, iridium, osmium, and others had their turn; and to make sure that a sufficient number of hundredweights should be at hand if required, a circular was issued to all the mining districts of North America, telling prospectors how to know the grains of platinum when met with. Sir Charles goes on to say:—"All the miners' devotion to the discovery of platinum for this purpose will now be wasted, for the fresh novelty is the old plan of using carbon in a so-called vacuum, but made this time of cardboard, which appears now to be considered the ultimate perfection as regards material; for I read that not only has this been tried, but 'thread splinters of wood, straw, paper, and many other substances,' which the writer supposes 'have never been tried before for the purpose.' Carbon of almost every form, and made in almost every manner, has been tried for electric lamps, in a vacuum, in nitrogen, and in air, with greater or less success; and for my part I do not see any special advantage in the use of carbon made from cardboard, any more, for example, than in carbon made from lignite (patented many years ago), or various other substances. That the electric light, pure and clean as it is, will progress steadily I have no doubt; but its progress has not been advanced by anything of great value during the last twelve months, which has been publicly shown, in the direction where advance is most needed, namely, the lamp. The generation of the current to produce the light can now be attained cheaply and regularly by the Gramme and other machines, but we still need a simple lamp which can be managed by an ordinary servant, and does not need the attention of an expert. Mr. Edison is a very likely man to devise this, but I see no reason to think from the description of his present light that he has done so yet." Further comment upon this matter is needless, and we still await the practical issues of Mr. Edison's latest development in electric lighting.

OUR TRADE SUMMARY.

PARTLY owing to the near approach of quarter day, and partly to the unhinging effect of the holiday season, in several of the more important centres the iron trades exhibited a little flagging during the bygone week; nevertheless there is no reason to doubt that they have entered with the new year upon a renewed lease of prosperity. Great excitement has prevailed in the Glasgow warrant market owing to the belief of a continued demand from America. It is alleged that under existing circumstances, a very large quantity of iron will be required for shipment when the navigation opens in the spring, and prices have in consequence gone up to over 70s. a month. Makers' prices have also risen about 5s. a ton, No. 1 Coltness and Summerlee reaching 82s. 6d. There are now in the Clydesdale district 100 furnaces in blast, as against 92 at the same period last year. The manufacturers are again in full work, with a press of orders for immediate delivery and rising prices; but the rush of orders for shipbuilding has ceased, and engineers and founders complain of slackness. The quarterly meeting at Middlesborough took place on Tuesday, and was numerously attended. Prices have been going up here for some time, and the recent returns of the Ironmasters' Association have not been without effect in maintaining the advance. Forge iron continues in request, and being mostly in the hands of makers, keeps its exceptionally high price. The finished-iron trade is if possible busier than ever, and prices have risen 5s. since our last report. Owing to causes already indicated business in Manchester on Tuesday was flat; but there was a good attendance, and prices for pig, although little more than nominal, still exhibited a strong upward tendency, a state of matters easy to be accounted for when it is known that most makers are sold over the next three months. The engineers, machinists and founders are still poorly supplied with work, with a not very immediate prospect of improvement. Throughout the whole of the north-western district there are signs of great activity. As to hematite pig, makers generally decline orders until those in hand have been disposed of. A considerable part of the output is taken up by the steelmakers, who are extremely well supplied with orders far in advance. Under such circumstances prices are necessarily firm, but there is no advance to report. Iron shipbuilders are very busy, and new orders are coming in. In the minor fields of Derbyshire, Lincolnshire and Notts, the iron industries continue to flourish. In West Yorkshire the trade in best iron is proceeding very satisfactorily, with no sign of check, but every prospect of continued advance. At present the whole available plant in the district is in operation, which has not been the case since the long depression fell upon the trade. The locomotive shops are also busier, and it would seem as if West Yorkshire is at last getting its full share of the general prosperity. In South Yorkshire matters continue in the same flourishing condition as heretofore; and from Staffordshire we learn that the result of the quarterly meeting at Wolverhampton was to confirm existing rates, with in some instances a rise. In the Forest of Dean there is a sluggishness in the iron trade owing to the near approach of quarter-day. From Cardiff we learn that while there as elsewhere ores have risen in price, the largest ironmakers are secured by contracts made early in the autumn. The cutlery trades of Sheffield are still flat, but there are good prospects of a speedy improvement, especially in the colonial market. The local trades of Birmingham and of the Wolverhampton district are also generally large; but there also signs of coming improvement are discernible. The demand for most descriptions of coal continues slack, and prices without improvement.

TORPEDO-BOAT PROGRESS IN 1879.

THE remarkable development which has taken place in appliances for torpedo warfare during the last few years has led to the introduction of many improvements in the class of vessels designed for this service. Primarly these improvements had reference to speed and related largely to build and engine-power. The highest speeds attainable under existing conditions having been, for the most part realised, attention was next more particularly directed to the improvement of the manœuvring qualities of torpedo craft. In this direction several special features in construction have been brought under public notice during the past year. The first of these was the Herreshoff torpedo-boat, which embodies several novel and important features. She was built in the United States by her designers, Messrs. Herreshoff, for the British Government, and we had the somewhat questionable pleasure of making a smart run in her "'mid snow and ice" in the Thames at Erith, upon her arrival in England in the early part of January, last year. This boat is 59 feet 6 inches long, by 7 feet 6 inches beam, and 5 feet 6 inches deep. Her special feature is the method of propulsion, which consists of a two-bladed screw-propeller, placed beneath the vessel in a central position, and driven through a curved flexible shaft by a direct-acting condensing-engine placed in the forward part of the boat. The vessel is steered by means of a balanced rudder placed a short distance from the stern and under the ship. It was demonstrated that the boat could be propelled ahead or astern with equal speed, and that she could be steered in either direction with equal facility. She was turned in a circle which was of a diameter of about three times her own length, and when going at full speed was stopped dead within a very short distance. She also performed other evolutions in a very satisfactory manner. She has since undergone numerous trials at the hands of the Admiralty, and has proved to be a very handy boat. She has, however, met with no fewer than four accidents, the first two being occasioned by the giving out of her boiler, which is on the coil principle. The third accident was due to the giving way of the framing of her fan engine, whilst the fourth was occasioned by the blowing away of a lubricating pipe, which led into the main steam pipe.

The question of rapid manœuvring has been carefully considered by Messrs. Yarrow and Co., of Poplar, and has resulted in the introduction by them of several improvements in the torpedo boats which they have built, both for our own and foreign Governments. The chief departure from ordinary practice here is the introduction of a forward rudder in addition to the one placed aft. The forward rudder is placed 10 feet from the stem, and the two are worked simultaneously and by the same gear. It has been ascertained from actual experiment that when going at a high speed the forward rudder has far greater control over the movements of the boat than the stern rudder. The forward rudder projects below the keel, and is so arranged that it can be drawn up into a well, which is built in the boat, somewhat after the style of a sliding keel in a centre-board boat. The advantage is that when the boat grounds the auxiliary rudder can be drawn up out of the way; and it is fitted in such a manner that should any damage occur the rudder can be let go and fall down quite clear of the boat. The top of the well up which the rudder rises when not in use is about six inches above the water-line, so that the top can be taken off and the rudder examined while the vessel is afloat. For the purpose of testing the soundness of the system, some interesting experiments were recently carried out by the Admiralty officials at Chatham with a first-class torpedo boat built by Messrs. Yarrow, and which on trial realised the high speed of 21 knots. The trials consisted in measuring the diameter of the circles described by the boat and the time occupied in making them, under the following conditions—viz., when the stern rudder only was used, and also when both were in gear, the results obtained were as follows:—With the stern rudder only, mean diameter of circle 187 yards; average time to complete the circle 2 minutes 14 seconds. With both rudders—mean diameter of circle, 103 yards; average time, 1 minute 32 seconds. These means were obtained from runs with the rudders hard over to port and to starboard, at full and half speeds, each mean consequently embracing four distinct experiments. Messrs. Yarrow have also dispensed with funnels in their torpedo-boats, the smoke and products of combustion passing out at the stern of the vessel. Thus there is less chance of the boat being seen by the enemy, and when seen there remains but little to fire at, besides which there is a clear deck for covering and for the necessary deck operations.

Early in March some trials were conducted on the Tyne with a screw steering apparatus, designed by Mr. Kunstädter, and having for its object the rapid manœuvring of vessels, especially torpedo-boats. This contrivance consists of the usual propeller, in addition to which is a second and smaller propeller, mounted aft, and running alongside the rudder-blade, and connected with the main shaft by an universal joint. In the introduction of this joint lies the principal virtue of the invention. Mr. Kunstädter claims that his steering-gear will turn a steamship more rapidly than any other apparatus, and that its manœuvring properties are otherwise exceptional. The principle of the arrangement, however, is not new, and we are not aware that any progress has been made in the direction of introducing this propeller into practice in connection with torpedo-boats.

Another cognate invention for present notice—and one, albeit, which has passed into practice—is the Mallory Propeller, which was first tried in England in 1878. During the past year it has made some progress —not very marked, it is true, but, then, it is not the province of meritorious inventions to flash suddenly into notoriety, and as suddenly to subside. The Mallory propeller is essentially adapted for manœuvring torpedo-boats or other quick-moving craft. It consists of a screw propeller of ordinary construction, driven through gearing by its own engines, and carried by, and working in, a fish-shaped casing. The casing, with the screw attached, is capable of rotation in a horizontal plane around a vertical axis. Rotation is imparted to it by hand, through a wheel, for ordinary steering, and by independent engines for rapid manœuvring. The rotation of the screw propels the vessel, whilst by the lateral movement of the casing and screw together the ship is steered. By the aid of this propeller, a vessel is moved ahead, astern, or sideways, or turned in a circle, the diameter of which does not exceed her own length, and otherwise manœuvred with ease and great rapidity by the helmsman, without stopping or reversing the engines. The system has been successfully applied in America to several vessels, and among them to the *Natalie*, a yacht 95 feet long, 12 feet beam, 7 feet 6 inches depth of hold, and 5 feet 6 inches draft of water. This vessel has been propelled and steered nearly 5000 miles by the aid of this apparatus, without a rudder. It has also the approval of the American Government, who have had it fitted in the *Alarm*, the largest torpedo ram of that Navy, and which is 175 feet long by 28-feet beam. This vessel is now nearly ready for trial, and a board of navy experts, ten in number (of which the chief engineer, Mr. B. F. Isherwood, is chairman), have been appointed by the Government to make a thorough series of experiments with her. In England the Mallory propeller is fitted in a launch 37 feet long by 9 feet 6 inches beam, the working of which we witnessed, and which proved so successful that the Admiralty gave directions for two torpedo boats and a pinnace to be designed, fitted with the apparatus. The pinnace has been built by Mr. J. S. White, of Cowes, and is now being fitted with her engines and steering gear, and will shortly be ready for trial. The results of the trial of this boat, as well as those of the *Alarm*, are looked forward to with considerable interest, inasmuch as, if successful, they will pave the way for the application of the Mallory propeller in numerous important directions.

Several inventions bearing upon the present subject have found their way into the Patent Office during the past year, but they have not, we believe, found their way out of it again, and into practical use, Of the merits of these it would be premature now to speak. One thing, however, is within our knowledge, and that is that more than one of these inventions treads uncomfortably—for its inventor—on the toes of some its predecessors. But patented inventions are very prone to indulge in this habit, which, after all, is but complimentary, for is not imitation the sincerest form of flattery? And with this reflection we conclude our notice of the past year's moderate progress in torpedo-boat practice.

TELEGRAPHIC PROGRESS IN 1879.

THE progress of telegraphy in 1879 has, as regards novelty, been principally marked by the extension of the use of the telephone on the telephone exchanges system, and as regards extension of works by some very long submarine cables. The Telephone Company, established some years ago for the supply of Mr. Graham Bell's telephones, has this year started telephone exchanges in London, Liverpool, Glasgow, Manchester, Birmingham, Sheffield and Bristol. The company use the Bell telephone as a receiver and Blake's microphone and induction coils transmitter. They have a number of subscribers, and each one can speak to the central station, and on demand is switched through to any other subscriber. The Edison Telephone Company of London was established in the summer for a similar object, and they use the Edison telephone, in which the transmitter is the Edison carbon telephone with induction coil and battery, and the receiver the revolving chalk cylinder telephone. This company is establishing branches in several parts of London, and is also establishing similar systems at Liverpool and Manchester, with a separate company at Glasgow. Private telephone circuits have been largely supplied by both companies. As regards submarine cables, we have first an Atlantic cable laid by Messrs. Siemens Brothers, from Brest to St. Pierre and on to Cape Cod in the United States, with a branch from St. Pierre to Canada. The cable was laid from the *Faraday* aided by the *Pouyer Quertier*. The cable is for a French telegraph company, called the "Compagnie Francaise du Telegraphe de Paris à New York." M. Von Chauvin was the engineer on the part of the telegraph company. The Telegraph Construction Company have laid a cable from Durban to Aden touching at Delagoa, Mozambique and Zanzibar, in all 3841 nautical miles for the Eastern and South African Telegraph Company. The Telegraph Construction Company have also laid a duplicate cable for the Eastern Extension and Australian Telegraph Company from Penang to Banjoewangi in Java, 1310 miles, and are extending the same on to Port Darwin, another 1180 miles. In both the South African and Duplicate Australian cables the shallow water cable has the core protected with a thin brass tape wound round it as a protection against the Teredo and other marine insects. The homogeneous iron wires of the outer covering in the deep sea portions are each separately protected with tape saturated in a preservation compound. The wires leading from the ends of these cables to the offices are laid in pipes filled with water, a plan proposed by Mr. Latimer Clark; many ingenious details necessary to carry this out having been arranged by Mr. Hockin and Mr. H. Taylor. Some of these aqueous land lines are 11 miles in length. The steamers employed in laying the above cables were the *Scotia*, 4666 tons gross; *Seine*, 3578; *Calabria*, 3325; *Edinburgh*, 2315, and the *Kangaroo*, 1773. The magnificent steamer *Scotia* was added to the company's fleet this year. She is a twin screw and has duplicate picking-up gear arranged on her main deck. Messrs. Clark, Ford, Hockin and Taylor were engineers for the telegraph companies. The Telegraph Construction Company also laid a cable from Arendal in Norway to Sylt in Jutland, 236 miles. This cable was laid from the steamship *John Pender*, belonging to the Eastern Telegraph Company, from whom she was chartered by the Telegraph Construction Company. The Telegraph Construction Company also made 120 miles of cable for the New Zealand Government.

The India Rubber, Gutta Percha, and Telegraph Works Company laid a cable in the steamship *Dacia* from Marseilles to Algiers, 500 miles, for the French Government, and also manufactured a cable for crossing the Caspian Sea, 147 miles, which was laid in that sea by Mr. Pallisen for the Russian Government. The cable was taken out in the steamship *Great Northern* to Cronstadt, and transhipped into barges and taken by river and canal to the Caspian, where it was again shipped in a steamer from which it was laid. A cable for the Spanish Government was made and laid by Mr. W. T. Henley between Spain and the Balearic Islands, 56 miles. Mr. Henley has also made some 52 miles in various lengths for the Danish and Russian Governments and some Telegraph Companies. Our Postal Telegraph System in England has not made any great expenditure on engineering works during the year, some 90 new offices have, however, been opened. The speed on the lines having submarine cables in circuit has been increased some hundred per cent. by placing relays at each end of the submarine cables. A great number of the Wheatstone automatic circuits have been duplexed and quadruplex has been introduced on several circuits. A new cable of 4 wires has been laid by the Post Office between Portpatrick and Donaghader.

Several new Telegraph Cable repairing ships have been bought or built during the year amongst these are the *Retriever* for the Eastern Telegraph Company, the *Pouyer Quertier* for the new French Atlantic Company, the *Grappler* for the West India and Panama Telegraph Company, the *Patrick Stewart* for the Government Indo-European Telegraph Department for the Persian Gulf Cable and one not yet named for the Great Northern Telegraph Company. The steamship *Great Northern* has been purchased for the Eastern and South African Telegraph Company.

The duplexing of submarine cable circuits has been greatly increased this year. The Anglo-American Company has duplexed their 1874 cable. Mr. Stearns having been engaged to do this, and the cable has been regularly working duplex since March with 80 per cent. increase of carrying capacity. The apparatus for duplexing the 1873 cable has arrived at the stations. The Duxberry and St. Pierre section has also been duplexed by this system, and its capacity is thus doubled. The Direct United States Cable Company have been trying experimentally the duplex system, as arranged by Messrs. Muirhead and Taylor, and are continuing experiments. The Eastern Telegraph Company have during the year duplexed the Porthcurno and Lisbon circuit according to the Muirhead and Taylor system.

The Anglo-American Telegraph Company repaired their Brest and St. Pierre cable at 160 miles from St. Pierre this year. The various cables in the English Channel and the North Sea have been repaired in various places in the steamship *Lady Carmichael* by Mr. Bordeaux, the Engineer to the Submarine Telegraph Company. The Wexford and Welsh Coast cable has been partly repaired, but requires a renewal of forty-five miles, which is being made by the Indiarubber, Gutta-percha, and Telegraph Works Company for the Post-Office, and the work of renewal will be done by Mr. Lumsden, who has, during the year, repaired the Shetland and Orkney cables, and the Jersey and Guernsey cable. The West India and Panama Company have executed a great many repairs in their cables, and are having 100 miles more cable manufactured by the Indiarubber and Gutta-percha Company, in addition to 100 miles they have already in stock at the works of this latter company. This will be used for repairs in their new cable ship, the *Grappler*. The Western and Brazilian Company have been renewing some 800 miles of their cables on the Brazilian coast, south of Para, where the cable originally designed for deep water was laid along the coast in many places in water too shallow for that type of cable. Some of the faults are attributable to the type of sheathing being unsuited to the dangers of shallow water, and some to the Indiarubber insulator (Hooper's) employed, which it is said, however, remains good in the deep water. All the cable used in renewal has gutta-percha for the insulator, and a close sheathing of galvanisd iron wires. A further quantity of 400 miles is to be ordered at once for further renewals.

The great lengths of submarine cables we have mentioned as having been manufactured in 1879 has naturally absorbed an immense quantity of iron and homogeneous iron wire, and it is a curious fact that the greater portion of this is supplied from Germany, the manufacturers at Cologne being able to supply wire delivered on the banks of the Thames cheaper than it can be supplied from Manchester. This is partly due to the cost of freight from Cologne to London by water being cheaper than from Manchester to London by rail. The wire supplied for the Post Office telegraphs for overground lines, where the iron wire has not only be mechanical strong, but has also to conduct electrically, is now specified by the Post Office engineers to be, besides a certain tensile strength, of a certain conductivity, and the English manufacturers have at present alone been able to comply with these conditions. It should be noted that the International Telegraph Congress was first held in London in the year 1879.

THE LONDON METAL TRADE IN 1879.

THE past year, with regard to the metal trade, has been characterised by the very extreme conditions of commercial enterprise—the utmost depression and the wildest excitement; but the former aspect, we must admit, has engaged the greater part of 1879. The close of the previous year left us in such a condition that many were the prophetic assurances that it was simply impossible for prices to further recede—that iron, tin and lead were not paying for their production, but, on the contrary, producers were sustaining heavy losses and would have to close altogether. 1879, however, dawned to convince the world of the idleness of such prognostications, and that depression in commercial circles is not so easily circumscribed, but only requires opportunity to develop its possibilities, for we then had values lower than the metal trade had seen for many years, in fact, with regard to lead, prices reached a point which had not been touched since 1848. Pig-iron also, which closed in December, 1878, at 43s., in July, last year, receded to 40s., about the lowest price in the year. We therefore see that the natural sequence of the undue inflation of 1872-3 exhausted itself in the year now closed. It was in August and September that a brighter prospect was manifest, which developed into the wildest extravagance. Perhaps it would be interesting to observe the progress of the pig-iron market during the year. The beginning of each month prices were, for Scotch pigs:—January, 43s. 2d.; February, 42s. 6d.; March, 44s. 1½d.; April, 42s. 8d.; May, 43s. 3d.; June, 41s. 7½d.; July, 40s. 8d.; August, 41s. 10d.; September, 47s.; October, 64s. 6d.; November, 53s. 7d.; December, 58s. 6d.; end of December, 68s.

This extraordinary advance was due chiefly to the American demand commencing about October, but by no means confined to this, for we find shipments to all parts of the Continent materially increased. America is now again making a stir in the pig-iron centres, accounting for the recent heavy rise.

The production for the year of Scotch pig-iron was 932,000 tons, against 902,000 tons in 1878. This feature is of more interest when we find that the larger amount was from an average of eighty-eight furnaces, while the smaller was from an average of ninety furnaces, thus showing the great increase now of productive power per furnace.

Manufactured iron also has fully participated in this revival. Makers are now occupied with orders taken in October last, since which time large contracts have been entered into at £2 to £3 per ton advance.

The metal which perhaps has been most affected, is tin. Beginning the year at £61 per ton for foreign, the market dropped still further to about £59 in February; from this it gradually advanced to £64 and £65 until August, when £71 was paid; the end of September and commencement of October it rose to £75; and now began a career of the liveliest excitement and most reckless operations.

From £75 per ton, by spasmodic rushes, it even reached £92 and ultimately £95 was paid. Suddenly there was a drop of £10, again an advance of £5, and, after fluctuating continually between this and £92, the market closes £91 with very firm tone. English tin was not quite so capricious in its movements, following pretty closely in the track of foreign, but now and then standing still, anticipating the next move.

About October, copper too was the subject of much speculation at prices £55 and £61 10s. and ultimately reaching £67 10s.

The tinplate business has passed through a crisis calling for special notice. Prices have been ruling at which it was considered impossible they could be manufactured without entailing heavy losses, and yet they *were* manufactured, and large orders entered forward at 14s., 14s. 6d., and 15s., and we have every reason to believe, at a profit. When the tinplate trade was at its lowest ebb, the announcement was made that the West of England and South Wales Bank had suspended payment. This cast an additional gloom over affairs in the Welsh districts, although in this event could be seen, we think, the precursor of after-improvement. Allied with this failure was the stoppage of Messrs. Booker and Company, together with one or two smaller works, which lent an impetus to speculative inquiry. The actual commencement of activity in the tinplate trade, however, dated from the "strike" of operatives which occurred the first week in September. At this time all the works but one in the South Wales district were closed, and large contracts cancelled. This naturally induced anxiety on the part of consumers to purchase, which, coupled with American demand for "tall" trade, gave a stimulus to prices which have since been well sustained, and have now almost doubled themselves, so that the outlook now of this industry surpasses the most sanguine expectations of that time. Other metals have shared more or less in the fluctuations during the past year which characterised our chief productions, and much speculation doubtless has complexioned operations in some quarters; but the statistical position of the metal trade to-day quite warrants the opinion that 1879, while having been the scene of untold depression and distress, has established the basis of a solid recovery in our commercial centres, and that the improvement is not the result of speculation, but rather *vice versa*.

HISTORY OF MODERN INVENTION IN THE MANUFACTURE OF IRON.

BY W. MATTIEU WILLIAMS, F.R.A.S., F.C.S.

(*Continued from page* 709, *vol.* xiv.)

THE BESSEMER PROCESS.—No. 8.

AS stated at the conclusion of my last notice, there is a supplementary claim in the specification No. 356, Feb. 12, 1856. This is for treating the ingots after they are cast. It is stated that "in some cases the ingots of metal contained cells or cavities; in such cases they are subjected at a welding heat to the action of a squeezer, which has grooves both on its upper and lower jaws, and the heated ingot is compressed between them to close the pores and weld their surfaces together, or a similar effect is produced by first hammering it in a suage." Also that "by the use of these grooved surfaces or suages, the cast ingot of metal is less likely to be broken than when hammered between two parallel flat surfaces which do not afford any support to the sides of the ingot." Even with this protection the ingot "is at liberty to extend itself in the direction of its length, and is, therefore, liable to be driven out in that direction, and thus escape from much of the force of the blow, and also to become broken." To obviate these a die or cavity is used, "in which the metal is placed, so that when an ingot or other mass of metal, refined as hereinbefore described, in a soft or welding state is put into the die, it may receive the most powerful blows or pressure without its parts being broken or scattered about." These precautions to prevent the parts of the ingot from being broken and scattered about appear very unnecessary to anybody who is familiar with the rough and ready manner in which modern Bessemer ingots are carted from the casting-pit and thumped under the steam hammer "between two parallel flat surfaces, which do not afford any support to the sides of the ingot." The ingots obtained at the date of this specification appear to have suffered from such usage, or Mr. Bessemer would scarcely have gone out of his way so far, and have added to this specification the long description and sheet of drawings representing his devices for thus preserving the ingots from fracture under the hammer. In present practice, any ingots that break at all under very severe hammering are at once rejected. The fact is that about this period the Bessemer process was trembling on the brink of failure. It had already excited much attention; a paper was read at the Cheltenham meeting of the British Association; long paragraphs had appeared in the newspapers concerning it; and it was discussed by everybody interested in the manufacture of iron and steel. I was engaged in Birmingham at the time, teaching practical science to the artizans at the Midland Institute, and had some warm debates on the subject with some irritating specimens of a rather abundant class of people. I refer to those who set themselves up as the possessors of superior sagacity, by adopting the very easy device of pooh-poohing every novel scheme, innovation, or invention. Seeing that more than nine out of every ten even of promising inventions actually fail, these impostors have no occasion to make any investigation in any case, or to understand the merits or demerits of anything, for, by simply condemning at random everything that is new, they are right nine times out of ten by dint of sheer stupidity and insolence. Then they can crow, or rather bray out, their "didn't I say so?" They were exultant at about this time, and even the thoughtful and competent watchers of Mr. Bessemer's invention began to give up the air-blowing process. Some specimens reached Birmingham, and were carefully examined by a very able chemist and technologist. He found that the Bessemer iron contained the same proportion of sulphur and phosphorus as the pig from which it was made, that only the carbon and silicon were removed, and that when beaten on an anvil it gave way. I tried some myself, and found that it was both red-short and cold-short in a deplorable degree. It cracked all round its edges when subjected to anything like ordinary forging. It was practically worthless.

What followed? How, then, did Mr. Bessemer escape the ruinous failure which almost everybody regarded as inevitable? It was done simply by the direct application of pure chemical science. Chemical analysis showed that, contrary to all previous theoretical anticipations, mere oxidation by the blowing of air was quite incapable of removing the sulphur and phosphorus contained in ordinary pigs, though it most effectually burned out the silicon and carbon. What was to be done? Many efforts were made to get rid of these by supplementary processes, one of which constitutes the concluding claim of the specification before us. It was to refine the crude iron in the manner heretofore described, carrying on the process until the most complete refinement is effected, and the iron is as nearly pure as may be; then pouring "the fluid iron into water, by which it becomes granulated, and the grains or shots so produced are afterwards to be converted into steel by the process of cementation in charcoal with upright retorts" in the manner described in the specification No. 1384, 18th June, 1855 (see IRON, vol. xiii. p. 323). This method, even if successful, was of little or no value, being about as costly as the old methods of steel making, and it was not until some time later that the difficulty was overcome by the simple unpatented and unpatentable device of analysing and carefully noting the chemical composition of different brands and samples of pig-iron, and thereby discovering that those made from the red hematites of Cumberland and Westmoreland contain only a trace of phosphorus, and but little more sulphur. When the silicon and carbon of these are oxidised by one or other of Mr. Bessemer's devices—best of all by the simplest—a nearly pure iron remains. Something more is required for the conversion of this into steel, the history of which will be described hereafter.

The next specification, No. 630, 15th March, 1856, chiefly aims at the application of the blowing process to existing furnaces, so that they may "be made use of in their present state for, or be altered and adapted to, the carrying out of my new mode of working with jets of air or steam, and thus by a single process produce an iron more or less decarbonised, according to the object to which it is to be applied." This "present invention, relates, firstly, to the peculiar modes by which the decarbonisation or partial decarbonisation and refinement of iron is effected, by means of currents or jets of atmospheric air on steam (alone or mixed), and which is made to impinge upon the surface or pass through or in contact with the metal while in a fluid state; secondly, in assisting the decarbonisation and refinement of iron, by the use of oxides of iron, and in the use of carbonaceous matters during such process; and, thirdly, in the manner in which the metal so treated is formed into ingots or masses suitable for being afterwards made into bars, plates, or rods by the process of hammering or rolling." The first part is carried out in some cases by forcing air or steam, or a mixture of them, below the surface of the melted metal, which collects in the hearths of blast and cupola furnaces used for smelting and founding, and allowing the air or steam to bubble up through the metal and then mingle with the blast used for keeping up the combustion of the fuel above. When applied to a blast-furnace a second set of tuyere-pipes are inserted below those carrying the ordinary blast, so low that they open into the lower part of the crucible or hearth containing the melted metal, and the ordinary tuyeres are placed a little higher than usual, to escape the splashing up of the melted metal. Hot or cold air, or steam, may be used, but air at ordinary temperature preferred, "because air is better capable of generating a very high temperature," but steam is used alone or mixed with air "when treating iron containing a large quantity of sulphur or other impurities having an affinity for the hydrogen evolved from steam." It is claimed that, besides the refining of the metal in the hearth, "the currents of air, or of air and steam, will in part combine with the carbon contained in the fluid metal, and produce combustion, and thus add to the temperature of the molten mass," and that "a part of the heat so generated will ascend among the materials, occupying those parts of the furnace that are above the fluid metal, and assist in the smelting of the ores." The metal, after this treatment, "may be drawn off from the furnace of a quality, or in a state of decarbonisation, suitable to the peculiar purposes for which such metal is required." It is preferred to bring it to the state of refined metal, while thus in the blast-furnace, and then to run it into the blowing apparatus described in the last specification; or this refined metal may be puddled, or otherwise treated, "by any known process capable of converting it into steel or malleable iron."

Cupola furnaces, used for foundry or other purposes, are similarly supplied with tuyeres for blowing air or steam, or both, into the melted metal. The specification states that "in this way the quality of foundry iron may be improved and modified so as to render it more suitable to particular uses, and, when desired, the iron may be converted into steel, or into malleable iron, by continuing the blast of air, or of air and steam, through the melted metal after the fuel employed for melting the iron has been consumed, and thus, in the same furnace, remelt and convert the iron. The melted metal of finery or running-out furnaces is treated in like manner and with the same objects. Refining furnaces in which pig-iron is melted, and also those receiving fused iron directly from the blast-furnaces (sometimes

PEYTON'S SMOKE-CONSUMING APPARATUS.

MANUFACTURED BY MESSRS. PAMPHILON AND CO., WHITTLESFORD, CAMBS.

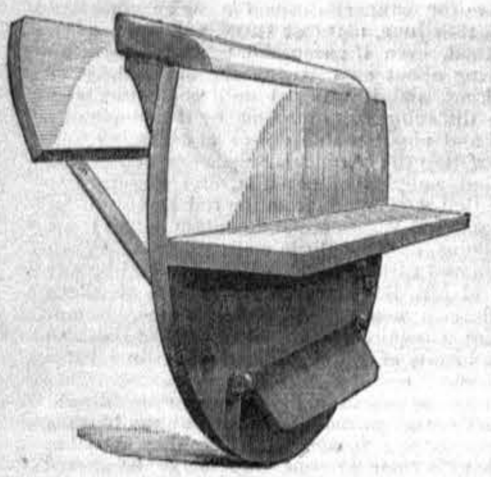


FIG. 2.

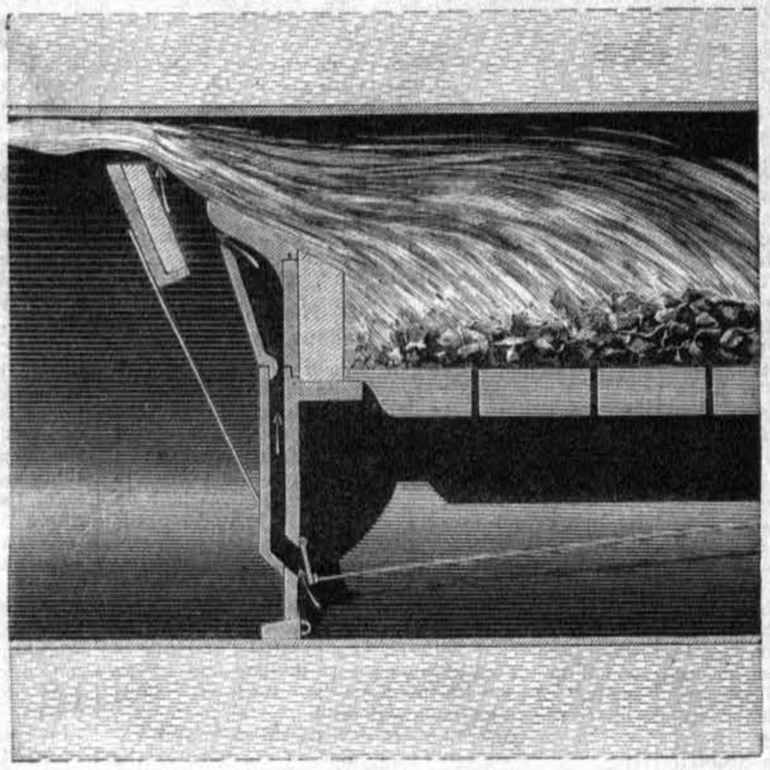


FIG. 1.

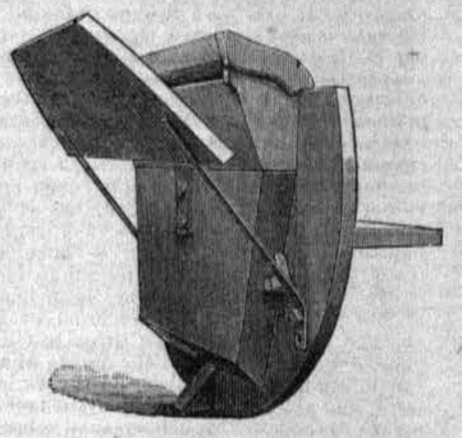


FIG. 3.

called "running-in furnaces"), are included. Mr. Bessemer states that in the ordinary process of refining, the finery, or plate metal, after leaving the furnace, is extremely hard and brittle, possessing less malleability and softness than iron presents in almost any other known condition, the requisite softness and malleability having to be obtained by puddling, and that "so far removed from the malleable condition is iron after it leaves the finery furnace, that of late years, in many instances, iron manufacturers have in some cases abandoned the use of their finery furnaces, preferring to perform the entire process of refinement and conversion in the reverberatory and puddling furnace." Also that heretofore, wherever refinery furnaces have been used, "fuel has been employed to keep up the temperature of the furnace and of the metal therein, manufacturers having been ignorant of the fact discovered by me, that by a judicious application of a powerful blast of air, so high a temperature can be produced in the metal without the employment of fuel, that the crude iron may be completely refined and converted into steel or into malleable iron; and this part of my invention consists in carrying out my invention in a refinery furnace, such as has heretofore been used simply to refine iron preparatory to puddling, and thus I obtain in such furnace steel or malleable iron in a fluid state," which may be cast or wrought in the usual manner, without any intermediate puddling. It is curious to note in connection with this passage, that Mr. Bessemer himself, in No. 44, dated less than three months earlier than this, viz., January 4th, 1856, describes so many devices of his own for the "more perfect and complete refinement of iron" by "continually bringing fresh portions of it (when melted) in contact with oxygen, and with intensely ignited fuel."

PEYTON'S SMOKE CONSUMER.

THE smoke which passes over the bridge of a Cornish or Lancashire boiler consists of carburetted hydrogen, which when united to a proper proportion of oxygen will burn at a certain degree of temperature. It is perfectly well known that the admission of a sufficient quantity of atmospheric air to the furnace of a steam boiler will cause the smoke to be consumed, but only at the expense of cooling down the flue that has been heated by the combustion of the fuel on the grate. In the smoke-consumer which we illustrate herewith, the principle adopted is to thoroughly heat and dry the air, take out all the damp particles and rarify the oxygen, and then mix it intimately with the smoke at the hottest part of the furnace. Fig. 1 of our engravings shows a vertical longitudinal section of this appliance, which includes the bridge, applied to the flue of a boiler; and figs. 2 and 3 are perspective views of the back and front of the smoke-consumer, shown separately. The air taken from under the bars is admitted by a valve, which can be regulated by a rod according to the requirements of the furnace, when it enters the chamber and takes the course indicated by the arrows at the back of the bridge. Here it becomes raised in temperature to 500° Fahrenheit, and, thrown back from the fire-brick deflector, is made to impinge on the smoke and flame coming over the bridge, when perfect combustion ensues. The cast-iron plate at the back of the firebrick bridge is corrugated so as to afford a larger surface for heating the air, and the plug shown at the bottom of the plate is for the removal of any incombustible particles that may have been carried over. This appliance is so strongly constructed of cast-iron as to last as long as the boiler itself; and the firebricks are not put in with mortar, so as to be easily replaced as often as required. The saving of fuel effected through the complete combustion of the smoke, the fact that this smoke consumer is self-acting and easily taken out to be refitted, and its durability, recommend it to the attention of steam-users. The manufacturers are Messrs. Pamphilon and Co., of Whittlesford, Cambridge.

TOOTH'S SYSTEM OF PERMANENT WAY.

UNDER the conviction that there is considerable room for improvement in the constructive details of the permanent way of railways—a conviction largely shared in by the community generally —Mr. W. H. Tooth has lately patented several new arrangements of rail-joints, rail-fastenings, and chairs. A trial of these inventions recently took place at the Millwall Ironworks, on which occasion there were present a number of gentlemen interested in railway and tramway construction. The object of Mr. Tooth's present invention is to reduce the wear and tear of both permanent way and rolling stock, to give greater comfort to passengers, and at the same time to reduce the cost of laying down new lines as well as that of maintenance. The principal part of the patent consists in cutting the end of the rail to a mitre or other suitable angle instead of a butt. By this means, as the carriage passes from bar to bar, Mr. Tooth holds that there can be no jolt, as the wheel of the locomotive or carriage never leaves one rail before it has passed on to the next, and that consequently there is no blow on the tyre of the wheel and less damage is done to axles, springs, plates, and couplings. In connection with this patent are also a number of chairs of different kinds. The principal one, which was tried at the Millwall experiments, suspends the rail by means of locked keys. The chair on one side fits close into and entirely fills up to the web of the rail, whilst on the other side is driven in an iron wedge or key, likewise filling up the hollow of the rail and extending itself to the floor of the chair, on which it rests, but in no way touches the bottom of the rail. On the outer side of the wedge and the inner side of the chair corresponding incisions are cut, and into this aperture wrought-iron plugs are driven, which effectually prevent the dis-displacement of the key and rail, thus dispensing altogether with the wooden key and bolts and nuts, and at joints with the fish plates, as these chairs are made double as well as single.

Several examples of ordinary rail joints and fastenings, as well as those on Mr. Tooth's principle, were tried upon the occasion to which we have referred. The first experiment was with an ordinary 80 lb. butt joint rail fastened together with fish plates and four bolts and nuts in the usual way. This bolt was placed in a hydraulic press, packed up at the end with sleepers and blocks, the chairs being placed 19 inches apart at equal distances from the centre of the joint. The pressure was then put on the joint, which fractured at 36 tons. The second experiment was made with a pair of 70 lb. rails, cut on Mr. Tooth's system to a mitre, and with the shoulders of the rail cut out square, into which was fitted a slightly heavier fish plate than the former, and packed up with chairs and blocks in exactly the same manner as in No. 1. This sample withstood a pressure of 52 tons, bending only slightly. Experiment No. 3 was with Mr. Tooth's cast-iron chair, connecting the two mitred ends of the rail without fish plates, bolts, or nuts, but with wrought-iron keys as before described. This example sustained a pressure of 48 tons, when it broke completely in two. In the fourth experiment, a pair of butt joint rails, with a patent cast iron fishing chair for the one side of the rail, and an ordinary fish plate for the other, was broken quickly at a pressure of 30 tons. In the fifth experiment, a suspending chair, in which the rail is supported on the shoulder and web by wooden key, came to the bottom of the chair with a pressure of 9 tons. In the sixth experiment a similar suspending chair, but with iron keys and wedges (as before described), sustained a pressure of 52 tons without showing any sign of giving way.

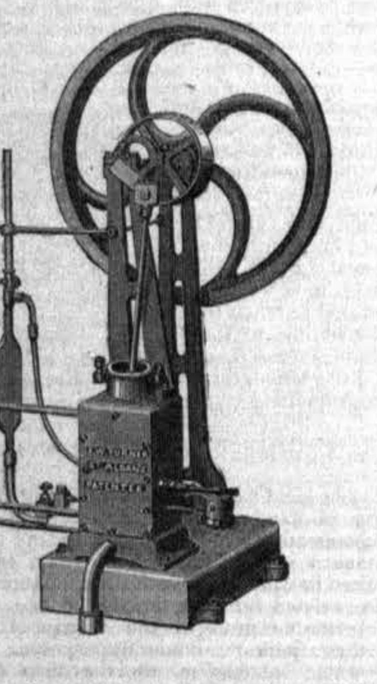
The results of these experiments go to show the superiority of Mr. Tooth's system as regards capability of resistence to dead pressure. As regards the behaviour of the system under the actual conditions of railway traffic, we understand that it is now being tested on the Great Eastern Railway at Stratford, where a short length has been down for some twelve months past under heavy traffic. Other things being equal, these two sets of circumstances point to the value of Mr. Tooth's invention for its intended purpose, and we hope it will ultimately prove useful in improving alike railway permanent way and railway dividends.

With regard to tramway construction, we may mention that Mr. Tooth has also patented the mitre joint in common with tramway rails, which are to be embedded in longitudinal blocks of granite fixed in with iron or wooden wedges. We should add that Mr. Tooth's inventions are being introduced by Mr. Worseldine, of No. 11, Laurence Pountney Lane, London.

TURNER'S GAS-ENGINE.

AMONGST others who for years past have given careful attention to the improvement of the gas-engine, is Mr. F. W. Turner, of the St. Albans Ironworks, St. Albans, who claims to be the first Englishman who brought out a working gas-engine, all others being of foreign origin. In 1874, he patented an engine, which was made and worked successfully by Messrs. Otto and Langen, of Cologne, and Messrs. Crossley Bros., of Manchester. Subsequently, being convinced of the necessity for a cheap and simple engine for superseding hand labour in driving small machinery, he applied himself to its production. The result of his labours was the gas-engine exhibited at the late Smithfield Club Show, and briefly noticed by us at the time. Two of these engines, of one and two man-power, were constantly at work during a recent trial of gas-engines at Nottingham, and we have lately been afforded an opportunity of testing the larger of these two engines, on the crank-shaft of which was keyed a 12-inch pulley, provided with a strap-brake attached to a Salter's balance. Making 180 revolutions a minute, the weight on the balance showed over 21 lb. This, multiplied by 3 feet, the circumference of the pulley, gives 11,340 foot-pounds, or one-third of a horse-power, which was obtained with a consumption of about 40 cubic feet of gas per hour, mixed with seven times its volume of atmospheric air.

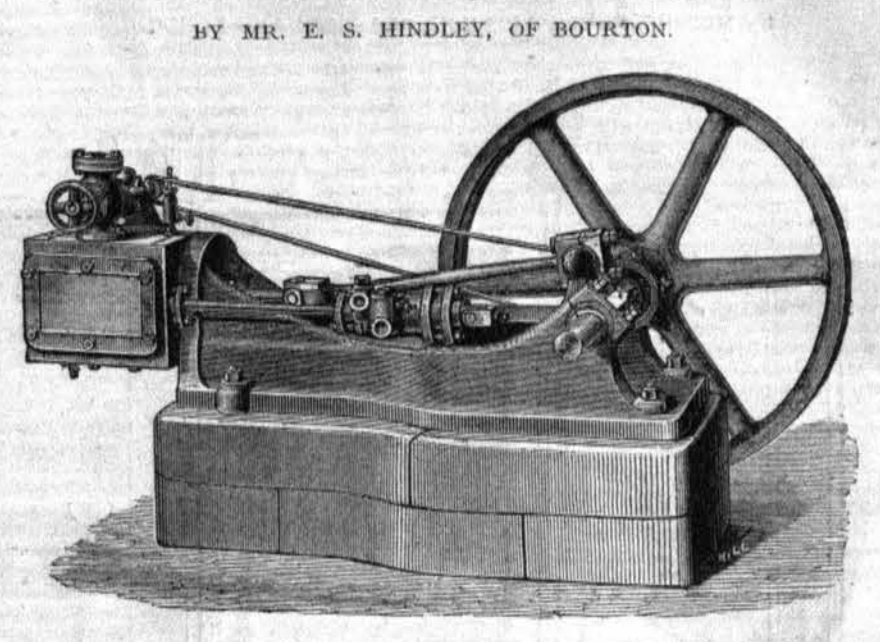
The engine shown in the accompanying illustration is free from complication, and has only three working parts. One distinguishing feature is that the centre line of the cylinder does not coincide with that of the shaft, the latter being about 1½ inches in the small size, and 2¼ inches in the large, outside the centre line of the cylinder. This arrangement, while permitting of a long crank with its powerful leverage, gives, with the aid of a long connecting rod, a very favourable angle of thrust. In fact, the 7-inch crank has the effect, as regards the angle made, of a 4¾-inch crank, which makes a difference of 200 foot-pounds in the dynamic effect of the engine. Like all gas-engines, this one is single-acting, and the whole of the thrust is given during two-thirds of the upward stroke. The cylinder is therefore surrounded, to this height, by a water-jacket, circulating pipes from which communicate, in one arrangement, with the tank forming a portion of the standard, and in the other with a cistern in another portion of the premises, the water of which is heated for any industrial or domestic purpose. The cylinder is 4½ inches in diameter, by 14 inches stroke. The piston is lubricated by syphons; and so slight is the friction that when gas and air are turned off the weight of the piston causes it to descend in the cylinder. The slide-valve, which is a perforated plate, works without friction, and in equilibrium between two faces—the cylinder and a back plate bolted to it; and the water passes first round this back plate on its way to the cylinder jacket, thus preventing the burning of the lubricant, and also that warping of the valve which has hitherto been a difficulty in gas-engines. The governor directly controls the admission of gas, more or less being admitted on the rising and falling of the spindle with its coned end fitting in to a conical seat.



The valve face is placed at the back and towards the bottom of the cylinder; it has three ports, the lowest one for exhaust, the next for the admission of the combustible gases, and the third also for admission when the second port is closed by the slide-valve. The cavity in the slide-valve admits the combustible gases to the cylinder, and in the interior of the slide-valve is a small igniting valve, which opens internally to admit the igniting jet, but closes during the combustion of the gases. The back-plate, already referred to, which has passages for the admission of air and gas, is provided with air-valves working in boxes, the motion of which is regulated by cup-shaped screws. The ignition of the gases is effected by a single igniting jet placed above the back-plate, on the top of which it impinges, spreading its flame so as to cover the igniting port, which, during the upward movement of the slide-valve, presents itself above the back plate and opposite the igniting jet. We shall watch with interest the further development of this simple and economic motor.

HORIZONTAL ENGINE.

BY MR. E. S. HINDLEY, OF BOURTON.



HINDLEY'S HORIZONTAL ENGINE.

THE accompanying engraving illustrates a horizontal engine which was exhibited by Mr. E. S. Hindley, of Bourton, Dorset, at the last Smithfield Club Show at Islington. It is one of a class now being turned out by this maker. These engines are substantially made, the form of the bed casting combining rigidity with simplicity and a graceful outline. Every part is most accessible, the crosshead and slipper have very large bearing surfaces, and are of a novel but correct form. Every wearing surface is adjustable; even the pump-rod joint has a heavy adjustable brass bearing. The crank shaft is large, and bent from a bar of the best scrap iron. It is carried in two long gun-metal bearings, with bearings of the same pattern in the connecting-rod, and all these bearings are turned externally as well as bored internally, so that any ordinary engine driver can replace them with new ones when required without the assistance of a skilled workman. The feed pump is designed on the most approved principle, discharging twice the quantity of water required. The flywheel, which is heavy and broad, is turned to take a belt; it can be placed on either side of the engine, provision being made for a pulley on the opposite side. The governor is of a new horizontal high-speed design, very sensitive, noiseless in action, and reliable to maintain the engine at any speed ordinarily required. The piston rod, slide rod and pins are all made of steel. The engine can be driven in either direction by changing one key, and all the parts being strong and well-proportioned, it may be safely and noiselessly run at a high speed. The cylinder is lagged with mahogany and brass bands, and many parts are finished bright. The entire engine is well made, and all parts are to template; special provision is made to prevent the oil from the bearings running about the bed.

RAILWAY CARRIAGE LIGHTING.—Referring to the article on this subject which appeared in our last issue, we are informed by Mr. G. Bower, of St. Neots, has had a system of enriched gas in use in one of the Great Northern Railway carriages for the past twelve months. We also understand that Pintsch's system of oil-gas lighting for railway carriages is largely in use for quick and long-journey trains on the Continent, and that in England it has been applied to several hundred carriages on the Great Eastern Railway, and is now being applied to the entire stock of the Metropolitan Railway.

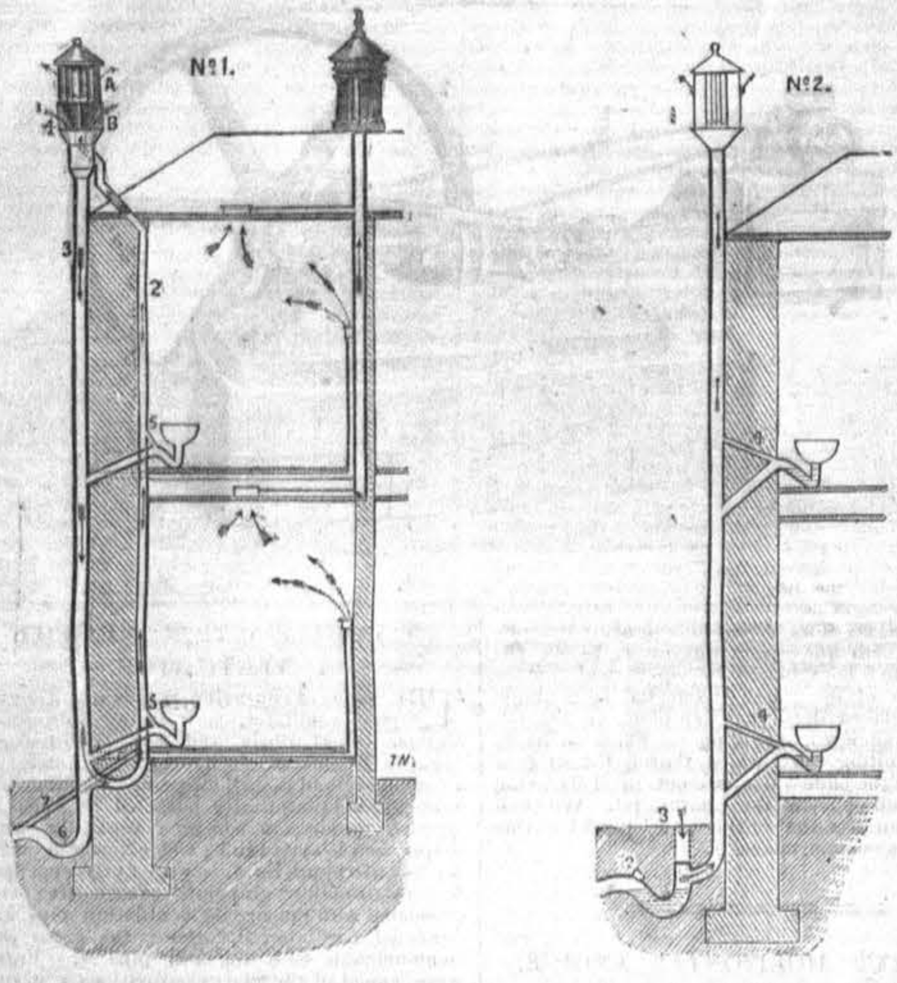
UNIVERSITY COLLEGE, LONDON.—Professor Kennedy is announced to give ten lectures on the Machinery and Plant used in the Manufacture of Iron and Steel, on Friday's, from 4 to 5, p.m., commencing on January 9th. Fee for the course £1 11s. 6d. The first lecture will be open to the public. Further particulars may be obtained from the college, Gower Street, W.C.

DOUBLE-ACTION SOIL-PIPE VENTILATOR.

THE annexed engraving represents a new soil-pipe ventilator, now being introduced by Messrs. Robert Boyle and Son, Ventilating and Sanitary Engineers of Glasgow and London. It is a combination of their "air pump" ventilator, and a downcast ventilator also patented by them which together produce a soil-pipe ventilator which is simple, and is stated to be very efficient in operation. As shown in figure No. 1, on page 24 the upper portion, A, consists of the "air pump" or extracting ventilator connected with the upcast ventilating pipe 2. The downcast ventilator, B, forming the lower portion, communicates with the soil pipe, 3. From the arrangement of the plates or divisions 4, it presents an open mouth (on the principle of the wind sail) to the wind from whatever quarter it may blow, forcing it down the soil pipe, and up the ventilating pipe as indicated by the arrows. By this means a double power is obtained, the force of the wind driven down, and the suction of the extracting ventilator keeping the soil-pipe aerated, and perfectly free from poisonous gases, which are not allowed to lodge or accumulate in the pipe. This ventilator has also the merit of being a fixture, with nothing movable to get out of order or make a noise. The fact of the air-inlet being at such an elevation insures a supply of air, and a force unattainable at a lower level. Assuming, however, that there was no movement in the air—a state of things which, according to high scientific authority, never exists—with this system there would still be a through current on the syphon principle, owing to the mouth of the down-cast pipe being lower than that of the up-cast. The soil-pipe is shown outside the house so that the up-cast pipe may have the benefit of the heat in the house, which tends to rarify the column of air, and which also derives a greater velocity from the colder and heavier air in the outside pipe rushing towards it and forcing it out at the top. The soil-pipe, however, can be placed with safety inside the house if desired so. The figures indicate ½ inch pipes to ventilate the discharge pipes connected with the w.c.'s and prevent the traps being un-syphoned by the passage of matter down the soil-pipe. The drain trap is seen at 6, whilst 7 is a 2-inch ventilating pipe connecting the drain with the up-cast pipe, where no provision is made. It is also shown in figure No. 1 how Messrs. Boyle ventilate the w. c. by means of one of their air-pump ventilators placed on the roof with a main pipe led down the wall and connected by means of a branch pipe with the centre of the ceiling. The fresh air is admitted through a vertical tube placed against the wall close to the door, so that the current of air will always have a direction from the door to the ventilator. The vertical tube is connected underneath the floor with an opening through the wall communicating with the external air. The ventilators are shown larger in proportion than they would be in reality, for the purpose of making their construction plain. Figure No. 2 shows the system of soil-pipe ventilation, which is at present most generally adopted. 1, Is a Boyle's Air-Pump Ventilator 10 inches in diameter, for creating an up-draught, and preventing a down-draught, which it has been found to do very effectively; 2, is the Drain Trap; 3, the fresh-air inlet to the soil pipe, by which means a through current is established. By the use of these and some other of Messrs. Boyle's sanitary appliances, the health of the community would no doubt be considerably improved, and our death-rate reduced in proportion. It would tend to the realisa-

DOUBLE-ACTION SOIL-PIPE VENTILATOR.

BY MESSRS. BOYLE AND SON, GLASGOW AND LONDON.



tion of that elysium of Salutland conceived and described by Dr. Richardson, who pays Messrs. Boyle the compliment of being the inventors of what he considers to be "a perfect system of ventilation."

OCCASIONAL NOTES.

A WARNING TO COUNTRY ARTISANS.

THE scarcity of employment in many branches of industry is inducing an immigration of skilled labourers into the metropolis. In ordinary times there is little demand in London for skilled labour, unless it is of the best, and the most capable workman, who comes up without an introduction of some kind, often experiences very great hardships at first; while, even when he does find a master, he also discovers that the higher money wages represent very little more of the necessaries or luxuries of life than the smaller sum he received at home, when the extra expense of house rent, the cost of conveyance to and from his work, and other things, come to be deducted. The difficulties attending poverty in a great city, where nearly all are personal strangers to each other, are also much greater than in a country town. An East-end clergyman calls on the Press to warn the artisans and labourers of the provinces who may be out of work against coming to London in search of it. He states that he knows at the present time several men who have come up in search of employment, and who are now living with their families in the lowest lodging-houses in Spitalfields, exposed to all the contaminating influences of these dens, while their wives and children are driven to adopt all kinds of expedients to obtain money for food and lodging. It is well, therefore, that the unemployed in the provinces should know that, just now, at any rate, they cannot possibly better themselves, but may make their position much worse by coming to town.

A COLOUR SCALE.

Inability to distinguish varieties and shades of colour where it exists, probably depends more frequently on ignorance than on physical imperfection. The only work on colour nomenclature we know of has been long out of print, and is now comparatively seldom to be met with. It was published in Edinburgh, in 1821, by Patrick Syme, the painter, brother of the eminent professor of that name, under the title of "Werner's Nomenclature of Colours," and is a thin octavo, with the pages arranged in columns, the first of which contains quadrangular patches of water-colour, examples of the colour terms employed by Werner, with, in the remaining columns, the name of a substance in the animal, vegetable and mineral kingdoms of the same hue. It would probably pay an enterprising publisher to issue such another scale, with the specimens perhaps a little larger, as a text-book for technical and other schools, and a manual of reference for naturalists and others, for whom Syme's book was intended.

THE ADULTERATION ON COTTON GOODS.

The Manchester Chamber of Commerce has been in correspondence with Lord Salisbury with regard to the report from Chefoo, of Consul Gardneri on the attempts by English merchants in China "to sell glue as cloth," and the consequent depreciation of Manchester goods in the native mind. The Chamber alleges that the practice of heavy-sizing, which means putting as much sometimes as 60 per cent. of gum, glue, china clay, and a hundred other things, into calico, to add apparent weight and strength to it, is simply to supply the demand for a cheap article, and adds that as long as there is a demand it will "naturally" be supplied by the manufacturers. If the foreign trade of this country is to be carried on upon this principle, the decadence of England, as an exporting country at least, will not be far off. It may be true, as the Bishop of Manchester, referring approvingly to this very correspondence the other day, said, that there is no fraud in the transaction as between the Lancashire manufacturer and the Bombay merchant; but, as the Bishop asks, is there no fraud anywhere? There is nothing dishonest in manufacturing a half-crown out of a pewter spoon and then surfacing it so as to look like silver. But when the maker is manufacturing for the smasher, and knows it, what about that? It is possible that the practice of counterfeiting half-crowns is not so injurious to the nation as the weaving of counterfeit calico. The merchants and manufacturers who constitute the Chamber of Commerce seem to forget that they are not the only persons interested in the cotton trade. The safety of the entire manufacturing population of the cotton districts is imperilled by their misconduct, and the evil is really such as to call for Government interference. "A Madrassee," perhaps a heathen, reads a lesson to the Christian Chamber and Bishop in this business, in a recent number of the *Standard*. He can see no difference between the adulteration of cotton fabrics with plaster and size and that of coffee with chicory. The Manchester Chamber of Commerce, he says, adopts a lofty moral tone on the unintentional adulterations of raw cotton by the Indian ryot, from indolence or carelessness, and has forced the Government to maintain an expensive department to suppress it. The plea of the Chamber that the Orientals knowingly prefer the adulterated to the genuine goods is denied by the Madrassee from his own knowledge; and as regards comparative cheapness he asserts that the genuine American are quite as cheap as the sophisticated Manchester calicoes.

BOILER EXPLOSIONS.

Every now and again boilers are exploding under circumstances which indicate utter recklessness or ignorance, or both combined, on the part of their owners. The recent case in Rochdale is about the worst that has occurred for some time back. There the owner, Thomas Barker, and his son, chain-makers, were killed, and a deal of damage done to property. Fortunately, the workmen were out of the premises at the time, or there would have probably been a much greater loss of life. The boiler which killed this man and his son had been worked at a pressure of about 63 lb., when it was in such a state of weakness from corrosion that it would not have been surprising if it had given way under half that pressure. It had been under inspection in 1863, but, two years after, Baker having neglected to pay his subscription to the company with whom it was insured, the insurance and inspection both came to an end. So that the boiler continued to be used after it was completely worn out. The coroner's jury before whom the inquest was held added to their verdict the sensible recommendation that all boilers in use ought to be periodically examined by competent persons, who should certify their condition to Government inspectors. Since this Rochdale explosion the boiler of a paper-mill near Blackburn blew up and wrecked the building, doing damage to the amount of £1000. Fortunately, in this instance there was none to life or limb. These accidents are continually occurring, and seeing that Government places dynamite, gunpowder and other explosives under stringent regulations as to handling and storage, it is difficult to conceive what excuse there can be for neglecting to protect the public against steam, which, in civil life at least, is doing more mischief than any of them.

THE BATTLE OF THE STREETS.

The Society for Preventing Street Accidents and Dangerous Driving is already doing good service to the public by obtaining and circulating accurate returns of the persons each week run over and injured or killed by vehicles in the streets of London. On Christmas week, as we reported at the time, three foot passengers were killed and forty-nine injured, within the knowledge of the society's agents, by being run over. On the following week the butcher's bill was reduced to 36; but the number of the killed was one in excess of the previous week. In both cases, vans and carts were the chief offenders, and in the latter one of the fatal accidents was due to a tramcar. At a meeting of the society on Monday the subject of carriage lamps was broached, and it was stated that it rests with the Home Secretary alone to enforce the use of lights upon street vehicles, that he had been written to upon the subject, and that he had promised to give his attention to it. It was also stated that the Volunteer Ambulance Department had offered to teach the officers of the society how to treat the victims of the frequent street casualties, and in the meantime to assist in giving aid to the injured. On the whole, this addition to the institutions of the metropolis is giving earnest of a useful career.

DISAPPEARANCE OF YOUNG GIRLS IN THE BLACK COUNTRY.

The local papers in the coal and iron districts of the Midlands publish alarming accounts of the disappearance of young women, under circumstances which suggest foul play, especially when taken in connection with the undoubted practice that has existed for some time in London, of carrying off respectable girls to the Continent and virtually selling them for immoral purposes. That such a practice should grow up is a deep disgrace to the Government of the country; for the law is almost impotent to prevent it, and the police authorities have either been ignorant or careless in the matter. As an example of cases in the country papers, the daughter of a gentleman, who with her father and mother, were returning from a watch-night meeting, stopped behind to speak with a friend and has neither been seen or heard of since. Three other young women in the same neighbourhood have recently disappeared in a similarly unaccountable manner, and there appear to be incidents of the same sort all over the district. These disappearances are quite common in India, but they ought not to occur in England. As to their cause, it is probable that the vile practice already referred to may account for the most of them; but some of the missing may have perished in the disused shafts scattered all over the district with little or no protection. An experienced Staffordshire coroner used to assert his belief that many persons, whom all their neighbours believed to have run away to America or elsewhere, had really left their bones lying at the bottom of some of these dangerous man-traps.

PHOTOGRAPHY.—The Emperor of Austria has presented the Austrian Gold Medal for Arts and Sciences to Herr Wilhelm Hoffmann, of Dresden, in recognition of his merits in advancing the art of photography.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.—The twenty-seventh annual meeting was held at the Cannon Street Hotel, on Saturday last, and was very fully attended. After the election of Mr. John Esson as an honorary, and of Mr. Johnson (of Chester), as an ordinary member, the auditors—Messrs. W. T. Coates and J. Cassells—presented the balance-sheet, and their report upon it. Both statements were deemed eminently satisfactory, and the funds now invested for all purposes amounted to £2,521 10s. 6d. The number of members of both classes is 345. Mr. J. Newton, C.E., presided, and delivered a long address, retrospective and autobiographical. Mr. Newton then retired from the chair, but was immediately, and for the twenty-second time, re-elected as President for the ensuing year. Mr. James Ronald was chosen as vice-President. Messrs. Douglas, W. J. Smith, and Coates, were appointed committeemen, and Mr. L. Ives was named junior auditor.

THE INSTITUTION OF SURVEYORS.—At the periodical meeting of the Institution of Surveyors, on Monday evening, a paper was read by Mr. E. R. Robson, architect to the London School Board, on "The Non-Educational Work of the School Board for London." This work Mr. Robson defined as the acquisition of property and the means adopted to render it available and suitable for the uses of the School Board. He stated that the superficial area of the London School Board district was 75,491 acres, and that the rateable value, which was £16,257,643 in 1869, had increased in 1878 to £24,065,174, showing an augmentation during that period of £7,807,531, or 48 per cent., with an estimated increase of population from 1861 to 1876 of 694,071, or a little over 7 per cent. Commenting on the increase in the rateble value of the metropolis, Mr. Robson remarked that while every one knew that the annual produce of a London rate increased, few would have expected to find the important fact set out in a table which he read—viz., that it had increased from £16,276,643 in 1869 to £20,903,377 in 1874, only five years later. The penny rate in the pound, which in 1869 represented £80,000, produced in 1879 £100,000. As regards population, the district of Westminster showed a decrease from 254,023 to 242,097, and the City a decrease from 112,013 to 55,608, between 1861 and 1876, according to the estimate of the Registrar-General. The enormous depopulation of the City, which between 1861 and 1871, according to the ascertained census, was 37,116, could only be attributable to the wholesale demolition of small house property for public improvements occurring in one particular decade, and not likely to occur again, or at least not to the same extent. The sites purchased had been 252 in all—viz., in City, 1; Chelsea, 23; Finsbury, 32; Greenwich, 25; Hackney, 34; Lambeth, 50; Marylebone, 17; Southwark, 26; Tower Hamlets, 41; and Westminster, 3. The total area of these sites is 5,685,768 square feet. The cost has been for property, including trade interests, £1,231,502 19s. 1d., and for legal and surveyors' charges, £180,869 7s. 7d., making a total of £1,412,372 6s. 8d. The average size of the sites is 22,562 square feet, and the average cost per foot 4s. 2¾d. The total cost of the 220 schoolhouses erected has been over three millions, varying in cost per head from £5 9s. to £16, and the increased cost of late years was owing partly to the great rise in prices, and partly to the requirements of the Education Department, which had necessitated an increase of the area per child from 9 feet to between 10 feet and 11 feet. The income of the Board for 1879 was—from grants, £121,877 7s. 8d.; fees, £72,377 3s.; rates, £525,173 11s. 3d.; loans, £348,000; miscellaneous, £7927 16s. 8d.; total, £1,074,315 18s. 3d. The expenditure had been, for sites, new school houses and furniture (since the formation of the board), £3,136,203 15s. 4d.; for interest on loans, £348,316 14s. 6d.; for repayment of loans, £85,972 10s. 6d.; maintenance of schools, £1,689,318 3s. 1d.; administration of bye-laws, £145,358 7s. 1d.; industrial schools, £174,822 18s. 7d.; office expenses, £103,170 9s. 4d.; miscellaneous, including postages, £142,491 14s. 1d.; or a total of £5,825,644 12s. 6d. for the eight years. The cost of each cubic foot for the school buildings, apart from the boundary walls, had varied from 5½d. to 7¾d., and at the present time, when prices are low, stands at 6¼d. The School Board rate is now 5½d. in the pound, and may perhaps be higher; but, in answer to the allegation of extravagance in providing "palatial buildings," Mr. Robson pointed out that the total amount spent in everything connected with the buildings and furniture, boundary walls and adjuncts, amounted to only nine-tenths of a penny in the pound, the sites themselves having cost ·57 of a penny. Thus the real pressure on the taxpayer arises not so much from the cost of building the schools as from the necessary work of carrying on and maintaining them. In the brief discussion which followed, many peculiarities of practice in arbitration under the Land Clauses Act were pointed out, and a vote of thanks to Mr. Robson for his valuable paper was unanimously accorded.

M. POURCEL ON COMBINATIONS OF CHROME AND IRON.—M. Al. Pourcel contributes to the *Bulletin* of the Société de l'Industrie Minérale, which is published under the direction of the Administrative Council of Saint-Etienne, a note, "Sur l'Analyse des Minerals de Chrome et des Produits Chromifères." His remarks on combinations of chrome with iron and steel are of considerable value.

LEIBNITZ'S CALCULATING MACHINE.—The *Hannoversche Courier* announces that Leibnitz's long-lost calculating machine has been recovered. Leibnitz invented and constructed this machine in 1672 during his stay in Paris. It can add, subtract, divide, and multiply, and was the wonder of the time. The machine became the property of the Hanover public library, but not long ago disappeared from among its treasures. All that was known about its disappearance was that it had once been sent to an instrument maker at Gottingen to be repaired. It has now turned up again in the Gottingen library, and through the efforts of Dr. Bodemann, the librarian of the Hanover public library, has again come into the possession of the institution.

DISCOVERY OF ANCIENT METAL WORK.—A highly interesting discovery has recently been made on the Russian peninsula of Kertch. The director of the Kertch Museum discovered a tomb dating from the third century B.C., and from the reign of Persidas II., King of the Bosphorus. The tomb is situated on the road from Temruk and near the Sennaja Station. In it were found (1) a thick gold necklace, with a lion's head at each end; (2) a gold crown of about one inch in breadth, the exterior part being formed of intertwisted rings, and ornamented with fine stones; (3) several pairs of gold earrings; (4) two gold chains, of which one is ornamented with figures; (5) two gold bracelets; (6) a round gold brooch, and a gold pin representing Venus and Cupid; (7) four gold leaves; (8) a pearl necklace, some amulets, and three small gold rings; (9) a phial, an urn, a vase, a spoon, &c.—all these of silver.

ART EXHIBITION AT AMSTERDAM.—The society of Dutch artists, "Arti et Amicitiæ," at Amsterdam, has intrusted to a committee the care of forming a loan exhibition of gold and silver objects of artistic value executed before the commencement of the present century. This exhibition will be held in the saloons of the society, Rokin, Amsterdam, in April, May, and June next, and the committee wishes to unite as many specimens of the following classes as may be obtained from churches, town-halls, corporations, museums, and the collections of private individuals who may consent to entrust them for some weeks to the custody of the society:—Objects in gold and silver—1, used for the celebration of different rites; 2, used by public and private corporations; 3, for domestic use; 4, personal ornaments; 5, select coins and medals illustrating the history of art, or bearing names of engravers; 6, documents, portraits, engravings, books, &c., bearing upon goldsmiths and their work. Though it is the aim of the committee that the bulk of the exhibition shall consist of gold and silver works of Dutch origin, yet it would be very agreeable to them if, by the aid of English and other foreign collectors, they might succeed in giving to the exhibition an international character, which would enable the visitor to study and compare the works of art of different periods and different nations. Mr. Wilfrid Cripps, Cirencester, has kindly undertaken to answer any questions that may be addressed to him by persons having objects that they propose to lend.

TECHNICAL EDUCATION.—The honorary secretaries of the City and Guilds of London Institute for the Advancement of Technical Education have forwarded to the managers of the important firms in the metropolis a circular calling their attention to the steps which have been taken by the institute to establish classes at the Cowper Street schools, Finsbury, for teaching science, with special reference to its technical applications to those who are engaged or who purpose to engage in the manufacturing industries. The circular states that Dr. Armstrong, F.R.S., Sec. C.S., and Mr. Ayrton, A.M. Inst. C.E., late Professor of Physics and of Telegraph Engineering at the Imperial College of Engineering, Japan, have been appointed to give lectures and laboratory instruction in chemistry and physics. Pending the erection of suitable buildings, these lectures are delivered at the schools on Monday evenings, and the practical instruction is given on Wednesday and Friday evenings. Dr. Armstrong has just delivered a preliminary course of twelve lectures on the first principles of chemistry; and Prof. Ayrton a course of twelve lectures on some of the practical applications of electricity. Two or three days ago Dr. Armstrong began a course on some of the applications of inorganic chemistry, including "The Chemistry of our Furnaces," to be followed by a course on organic chemistry; and Prof. Ayrton will give twelve lectures on "The Principles of Machinery," to be followed by a course on "The Applications of the Laws of Heat to Steam and other Engines." On Wednesday the practical class in chemistry was begun, and to-day the class for laboratory instruction in the use of physical apparatus and in possible further practical developments and applications of physical knowledge will commence. The lectures will not only be very fully illustrated by experiments, but, in order to render them of greater value to the practical student, as far as possible also by the exhibition of machinery and instruments (or models of them) actually employed in practice. The fee for a course of 12 lectures is fixed at 5s., but to persons attending the course on both subjects the fee is 7s. 6d., while single lectures may be attended on payment of 6d. For each practical class of eighteen demonstrations the fee is 7s. 6d.

ARTIFICIAL DIAMONDS.—Dr. Percy writes to the *Times* with regard to Mr. Maclean's alleged discovery:—"I agree with Mr. Maskelyne in thinking there is reason to expect that the diamond will some day be artificially produced. But, if so, possibly a very long period will be required to form a crystal of sufficient size and quality to be of any commercial value. Alumina, the substance of sapphire and ruby, has long ago been crystallised, yet to this day no artificial sapphire or ruby worth a farthing has appeared in the market. The balas ruby, or red spinel, was formed about forty years ago by Ebelmen, in small but distinct crystals, of which I have specimens in my collection; yet, so far as I am aware, the natural gem is alone known to jewellers. The conditions under which nature has crystallised carbon in the cubical system must be extraordinarily rare, seeing that a small room would probably suffice to contain all the diamonds that have hitherto been discovered. The possessors of diamonds have not at present any reason to fear that the value of their property will be lowered by the crystallised carbon of the chemical laboratory." In reply to Mr. Story-Maskelyne's letter on this subject, referred to in last week's IRON, Mr. McTear says:—"I have just seen Mr. Maskelyne's letter in the *Times*, and am surprised to learn first from it of the negative results Mr. Maskelyne has obtained, while an interview between us, fixed by him for Tuesday, 6th inst., is still pending. The statements in his letter do not prevent me from affirming in the most positive manner that I have been able to produce carbon in the diamond modification. I have been able on the only two occasions I have tried the experiment to burn the small translucent particles in oxygen gas, and I have been able with the greatest ease to scratch deeply both amethyst and topaz with them. As I do not despair of convincing Mr. Maskelyne himself of his being, to say the least of it, premature in his conclusions as to the problem of the crystallisation of carbon having been successfully solved, and as it has been accomplished by means very similar to those which in the concluding paragraph of his letter he suggests as being possible, I trust the scientific world will suspend their judgment until more ample evidence has been laid before them." At the Glasgow Philosophical Society, on Wednesday night, Mr. St. John Vincent Day read a communication from Mr. Robert Baxter, of Dundee, regarding the production of artificial diamonds. Mr. Baxter began to experiment in 1876, but did not obtain successful results till April, 1877, when pure crystals of carbon were produced. The crystals then obtained were all lost through careless handling. Mr. Baxter endeavoured to procure more, but for several months did not succeed. His crystals had been tested in a manner leaving no doubt about their genuineness. He had tried without success to produce large crystals, but saw no reason to prevent their ultimate production.

THE ARTISANS' INSTITUTE.—On Monday night Mr. Morley, M.P., presided at the opening meeting of the New Year's Session of the Artisans' Institute, at the rooms of the society, 29, Castle Street, St. Martin's Lane. The object of the institute is to provide the artisans of London with the same kind of technical education that is afforded in the trade schools on the Continent, by means of classes, which are placed under the direction of competent instructors. Mr. Morley, in his opening remarks, referred to the various technical classes which were conducted at the institute, and said that they brought into prominence the relations between employers and employed, which could not be pressed too often or too publicly, as that would be the means of solving many of the difficulties at present existing between them. He deprecated the action of certain persons who were endeavouring to indoctrinate the working classes with the idea that employers and employed were naturally born enemies, whereas it was the fact that they were mutually dependent upon each other. They had a common interest, and it was by the aid of classes of the character he was then advocating that a solution of the points which were at present causing great embarrassments would be brought about. As a large manufacturer, he believed that he was as much dependent upon his workmen as they were upon him, and their work would be better, more thorough, and more efficient, just in proportion as they were willing to work under a sense of justice to those who employed them. If that principle were to be generally adopted by both masters and workmen it would be a great thing for the industry of England. The Artisans' Institute was doing a great deal, thanks to Mr. Hodgson Pratt and others, to help the working men into a position of independence. Its object had been to induce workmen to instruct themselves in all the technical details of their labour, in order that they might be better qualified for the performance of their work, that it might be of a more skilful character, and in respect to which they would receive a higher return in the matter of wages. He had known men in the north of England who, by attending technical classes, had doubled and trebled their wages. He had no doubt that knowledge was elevating in its tendency, that it was a source of happiness, and was, in the best sense of the word, power; but it was well they should recognise the fact that their own material interests could be promoted, and their social advancement, happiness, and efficiency in their work brought about by the kind of knowledge to be obtained at institutions of this kind. It was a great surprise to him that there was so small an attendance at the classes. Instead of 80 or 90, there should be at least 800 or 900. He regretted also that there was too much self-indulgence on the part of working men. He was as fond of a holiday as most men, but he wanted to see a limit put to the tendency of the working classes to pleasure seeking, especially of an evening at the end of their day's labour. In the City lately they had heard a great deal in regard to technical education, and no doubt the City companies were going to do something in this direction on a very liberal scale. It was not yet decided as to what form their efforts would take, but it was certain that they could not do better with the large funds at their disposal than promote, by wise methods and well-arranged plans, the increase of technical education among the young artisans of the metropolis. He was sure that if the City companies would place themselves under the guidance of men competent to help them, what they did would be of immense service to the industrial classes of this country. Mr. Hodgson Pratt briefly addressed the meeting, and asked all those who took an interest in technical education to recognise the fact that this institute was on the right track and doing good work. The meeting was also addressed by Messrs. J. C. Fitch, E. J. Watherston, H. Trueman Wood (secretary to the Society of Arts), William Trant (who recently had visited Havre to draw up a report on the technical schools of that city), and others. The proceedings terminated with a vote of thanks to the chairman.

OLDHAM SCHOOL OF SCIENCE AND ART.—The annual distribution of prizes gained by students attending the Oldham School of Science and Art, took place on Monday night, in the presence of a crowded assembly, in the Oldham Town Hall. The chair was occupied by Mr. S. R. Platt, and the prizes were distributed by Sir Edward Watkin, M.P. Mr. T. Bailey (the secretary) read the report, which stated that during the summer there was a slight decrease in the number of students, which caused the year's total to be rather below that of 1878, but notwithstanding the depression of trade and temporary removal to the old post-office buildings, those who joined the winter classes were in excess of the previous year. The present session bade fair to be larger than any former one, as already 400 students had joined the science classes. The number of successes, 422 in 1879, was greater than ever before, and the increase in the advanced stages showed the steadily-improving character of the work accomplished. The aggregate amount of the prize exhibitions and scholarships obtained in 1879 was £1,228, against £740 in 1878. Sir Edward Watkin, M.P., before distributing the prizes, delivered an address. He said the question they had before them that night was mainly the result of the application of science and art to the production of commodities. They might be asked whether the end and aim of their existence was simply the production of wealth. He did not think they would consider for a moment that material questions were everything in this world. He believed if they were asked what was the capital of Oldham, they would say, looking at the enormous manufacturing establishments there were, the bricks, but what would bricks be without brains? They would say that the reason why Oldham was holding its own, and had progressed so rapidly in every department of manufacture, was because they had a people whose heads on the average were bigger than the average—whose bodies on the average were stronger than the average, and whose industry and determination were a great deal more than the average of any place. It was altogether a question of head; but the head was of no use unless it was cultivated, and what they in that school were endeavouring to do was to cultivate the head in the direction of manufacturing industry of different kinds. The man to whom they owned all that progress was the late Mr. Platt, who was one of the first to discover that, if Oldham was to hold its own, Oldham, in addition to being more industrious on the average, with more physical and mental power than the average, should be more instructed than the average, and therefore he established science and art classes. We were told we had been going through very bad times, and that we were coming into better times. Hitherto he was very sorry to believe that whenever we had a period of prosperity we did less work, worse work, and at dearer prices, but he hoped that a period of depression had taught us that if we were to continue as a nation our manufacturing supremacy, we must do more work, better work, and at lower psices. He was rather an old-fashioned man, and believed in hard work. He did not believe in short time and holidays, and laying bricks with one hand instead of two and all that sort of thing, and they might depend upon it if they went upon the old principle of four or five years ago, of less work, worse work, and dearer work, all the science and art classes that ever were placed upon the earth would never make this country a great manufacturing or commercial nation. There were no investments that produced so much as investments in improving the intellect of the working man. They had found that out in America. And what were they doing? Competing with England in spite of protective tariffs and high wages by their intelligent working men working a perfect machine. Good machines could be made here, but attention should be paid to this subject. If everybody thought it was everybody's duty to do that which was everybody's interest nothing would be done; therefore, in conclusion, he urged most strongly upon manufacturers and others who had not subscribed to that institution to come forward, if it was only in their own interest, and stimulate the work which was going forward. If they only brought forward every year the number of young men who appeared there that night they would have done a great public good, and something at all events to increase the honour and credit of the borough of Oldham. Sir Edward Watkin then distributed the prizes, and the proceedings soon after closed.

DR. FARR AND THE OFFICE OF REGISTRAR-GENERAL.—It was announced some months since that Major Graham, who has held the office of Registrar-General for more than thirty-seven years, would retire at the end of 1879. When Major Graham assumed office he found in charge of the Statistical Department of the office Dr. William Farr. The accomplishments of Dr. Farr as a statistician and as an administrator are so widely recognised, not only in this country but throughout Europe, that it is superfluous to dwell upon them. It is certainly not too much to say that throughout the world Dr. Farr is known as the greatest vital statistician of Europe, and is a man who may be said almost to have created vital statistics, in the sense in which they are now understood. His tables, his letters and appendices are classic, and the models which he has created have been slowly adopted in every civilised country. Indeed, so conspicuous has been the ability of Dr. Farr and so universal the reputation which his work has attained, that to the public at large Major Graham has been even unduly unknown, and perhaps nine people out of ten have for many years been of opinion that Dr. Farr is the Registrar-General. When the announcement was made that Major Graham would retire, the whole of that part of the public who were professionally interested in this question, and all the press who deal with it expressed a hope—tantamount, indeed, to a conviction—that Dr. Farr, as the natural successor to Major Graham, would long enjoy the higher official position which seemed naturally to open to him. The office is one, it is needless to say, of very great scientific and of great national importance, and the way in which Dr. Farr has understood his duties, and the special technical knowledge of all the medical as well as the purely statistical departments of it, have made him invaluable in framing classifications as well as in interpreting the statistical results which the Registrars report. Unfortunately, it appears that the Government has not considered that the post requires any special training or any technical knowledge, for it is only upon this assumption that it is possible to explain the course which has been taken. The new Registrar-General has certainly not shown any special qualification for the office, nor is he known to possess any of the technical knowledge so likely to prove valuable.—*Truth*.

MEETINGS FOR THE WEEK.

MONDAY, JANUARY 12.

ROYAL MASONIC INSTITUTION.—Noon.

LONDON INSTITUTION.—5 p.m. Professor Bentley on Epiphytes and Parasites.

MEDICAL SOCIETY.—8.30 p.m.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.—8 p.m. Mr. W. Simpson on Buddhist Architecture in Jellalabad Valley.

ROYAL GEOGRAPHICAL SOCIETY.—8.30 p.m. Mr. G. J. Morrison. 1. The Grand Canal and Yellow River of China. 2. Hankoo to Canton.

ROYAL ACADEMY.—8 p.m. Mr. J. E. Hodgson. A Parallel between the Arts of Poetry and Painting.

TUESDAY, JANUARY 13.

ROYAL INSTITUTION.—3 p.m. Professor Schafer on the Physiology of Music.

ROYAL HORTICULTURAL SOCIETY.—1 p.m.

ROYAL HUMANE SOCIETY.—General Court, 4 p.m.

PHOTOGRAPHIC SOCIETY.—8 p.m.

ROYAL MEDICAL AND CHIRURGICAL SOCIETY.—8.30 p.m.

WEST LONDON SCIENTIFIC ASSOCIATION.—8 p.m.

INSTITUTION OF CIVIL ENGINEERS.—8 p.m. Address by Mr. Barlow, the Precident.

ANTHROPOLOGICAL SOCIETY.—8 p.m.

GRESHAM HALL.—6 p.m. Professor Symes Thompson. Popular Lecture on Physic and Hygiene.

WEDNESDAY, JANUARY 14.

ROYAL LITERARY FUND.—3 p.m.

GRAPHIC SOCIETY.—8 p.m.

HUNTERIAN SOCIETY.—8 p.m.

ROYAL MICROSCOPICAL SOCIETY.—8 p.m.

AMATEUR MECHANICAL SOCIETY.—3 p.m.

SOCIETY OF ARTS.—8 p.m. Mr. Thomas Bolas on Modern Autographic Printing Processes.

GRESHAM HALL.—6 p.m. Professor Symes Thompson. Popular Lecture on Physic and Hygiene.

SOCIETY OF PUBLIC ANALYSTS.—4 p.m Anniversary.

BRITISH HOROLOGICAL INSTITUTE.—8 p.m. Mr. G. M. Whipple on Sunshine, and Various Modes of Observing and Registering it.

THURSDAY, JANUARY 15.

ROYAL INSTITUTION.—3 p.m. Mr. H. H. Statham on Modern Architecture since the Renaissance.

LONDON INSTITUTION.—7 p.m. Mr. J. Harrison on a Course of Reading in History.

NUMISMATIC SOCIETY.—7 p.m.

ROYAL ACADEMY.—8 p.m. Mr. E. M. Barry on Architecture as a Fine Art and an Art of Utility.

CHEMICAL SOCIETY.—8 p.m.

GRESHAM HALL.—6 p.m. Professor Symes Thompson. Popular Lecture on Physic and Hygiene.

LINNEAN SOCIETY.—8 p.m. 1. Mr. H. M. Brewer. Remarks on the Birds and Mammals Introduced into New Zealand. 2. Mr. J. G. Baker Synopsis, of Aloineæ and Yuccoideæ.

SOCIETY OF ANTIQUARIES.—8.30 p.m.

ROYAL SOCIETY.—8.30 p.m.

HISTORICAL SOCIETY.—8 p.m. 1. Mr. Henry H. Howorth. The Early History of Sweden. 2. The Rev. J. G. Fleay. The Known Lists of Actors from the Opening of the London Theatres in 1577 to their Closing in 1642, as Connected with the Literature and History of England. 3. The Rev. Dr. Rogers. Historical Notes on the Abbey of Cupar.

FRIDAY, JANUARY 16.

CITY OF LONDON COLLEGE.—6 p.m. Dr. Heinemann on Political Economy.

PHILOLOGICAL SOCIETY.—8 p.m. Dr. J. A. H. Murray, President. A Dictionary Evening.

ARCHITECTURAL ASSOCIATION.—7.30 p.m. Mr. Robert Walker on Competition.

ROYAL INSTITUTION.—8 p.m. Weekly Meeting, 9 p.m., Professor Dewar on Investigations at High Temperatures.

SATURDAY, JANUARY 17.

ROYAL INSTITUTION.—3 p.m. Professor T. Rupert Jones on Coal.

MINERALOGY AND MINING.

MINING PROSECUTION.—The Home Secretary has instructed Mr. Dickinson, Chief Inspector of Mines, to institute legal proceedings against the responsible manager of the Scowcrofts Colliery, Kearsley, near Bolton, in which an explosion took place on Christmas Eve, and from which seven deaths have resulted.

NEW MEXICAN MINES.—The States of Nuevo Leon, Coahuila, and Durango, in Mexico, have recently been invaded by an army of miners from Texas, and other parts of the United States and of Central America, attracted thither by the reports of the discovery of new gold mines of fabulous wealth. The mines are situated in the Sierra Mojado, and having been carefully examined by an engineer and mineralogist appointed by the Mexican authorities, are stated to be of incalculable value.

STRAITS TIN.—Some interesting statistics have been given by Dr. Reyer in the *Oesterreichische Zeitschrift fur Berg und Huttenwesen* on the tin production of the Banca and Billiton Islands. The island of Banca, which is a continuation of the mainland of Malacca, is of granite, graduating into syenite, and flanked by Silurian slates and quartzites. The ore was worked here to a considerable extent during the last century by the sultans of Palembang, the yield having reached 4000 tons per annum. This production afterwards fell off very much, and when the Dutch obtained the island, in 1821, it did not amount to half that quantity, although it now surpasses it, viz.:—1820-29, 1500 tons; 1830-39, 2700 tons; 1840-49, 4100 tons; 1855-59, 5200 tons; 1860-69, 4700 tons; 1870-77, 4400 tons. The average annual amount of tin per mine does not exceed half a ton, though the washings at Blinjoe average one ton per annum. The island of Billiton, as a tin mining district, only dates from 1850, the yield for the first ten years being only 180 tons. Since then, however, it has risen so rapidly that between 1870-6 over 3600 tons were raised per annum. The population of Billiton has increased from 14,000 in 1860, to 28,000 in 1876; of these, a good number consisted of Chinese miners. There were only 400 of these in 1860, and 4300 in 1873.

THE CLEVELAND PIG-IRON TRADE.—The statistics of the Cleveland pig-iron trade were issued in the beginning of the week. They have been eagerly looked for, and much speculation has been indulged in respecting them. It is particularly gratifying to find that they are more encouraging than could have been hoped for, notwithstanding the great improvement which has appeared lately. During the month of December the make of Cleveland iron was increased 3540 tons, and hematite 7289 tons. The total production for the month was 180,187 tons. Notwithstanding this great increase makers' stocks of Cleveland iron are decreased by 13,662 tons, and, although there is an increase of stocks in warrant stores amounting to 14,061 tons, the position must be considered most satisfactory. The shipments, though the weather was severe in the early part of December, exhibit a net increase of 10,300 tons upon the month of December, 1878. The comparative statement which is annexed to the returns exhibits the make and stocks of the district for the last ten years The total production in 1879 was 1,781,443 tons, and, although that is lower than it has ever been since 1870, the Durham strike mainly accounts for the difference. The total stocks amount to 282,886 tons. Of the total stocks makers hold 160,812 tons, and warrant stores 122,074 tons. There are now 96 furnaces in blast, against 82 at this time last year.

SANITARY ENGINEERING, GAS AND WATER.

WATER ANALYSIS.—Professor Frankland, whose name is popularly associated with water analysis, has prepared his long-promised work on the subject. It will be published during this month by Mr. Van Voorst.

THE MEDICAL OFFICER OF THE LOCAL GOVERNMENT BOARD.—The Medical Officer of the Local Government Board, Dr. E. C. Seaton, has resigned his office. His health, it would appear, has for some time been giving way; and it is now thought desirable by his medical advisers that he should withdraw from the arduous and responsible duties of his post. Dr. Seaton succeeded Mr. John Simon, on that gentleman's retirement in 1876. Previous to that time he had acted as assistant medical officer to the Board, in which capacity he particularly devoted himself to the work of public vaccination, and succeeded in bringing the administrative arrangements of this important branch of the public service to a very high state of efficiency. Dr. Seaton is succeeded by the late Assistant Medical Officer of the Local Government Board, Dr. George Buchanan, who became attached to the Privy Council Office in 1869 as an inspector of public health, but who, prior to his appointment, had already been largely engaged in conducting health inquiries for the Government.

THE LONDON WATER SUPPLY.—The *Land Agents' Record* states:—"We understand that Messrs. Smiths and Gore, land agents, of Whitehall Place, have been instructed by the Home Secretary, Mr. Cross, to make the necessary negotiations for the purchase by the Government of the rights and interests of the various London water companies, and that such negotiations are now proceeding. It will be remembered that it was suggested by Mr. Cross in the House of Commons last session that these interests should be taken over either by the Government and the Metropolitan Board of Works as jointly interested, or that the operation should be undertaken solely by the Government, through the Home Department, by means of a private Bill. This latter is the course which we understand has been decided upon, and Messrs. Smiths and Gore have been chosen to carry it through. In regard to this important Government undertaking, it is well to remember the statement of Mr. Cross in Parliament, that the basis of the terms of purchase, if such were decided on, would be the market price of the companies' stocks on July 29, 1879."

PRICE OF GAS IN GERMANY.—The introduction of gas into Germany, as into other Continental countries, has mainly been the work of Englishmen, and many Continental gasworks still belong to British firms and companies. Of late years, however, the local corporations have been purchasing such works from the native or foreign firms or companies who were the original founders and proprietors, the object generally being to cheapen the price of gas both to the town authorities and private consumers. In a recent issue the *Cologne Gazette* gives the price of gas in fifty of the largest towns in Western Germany. The highest price is charged at Bingen, where it is 9s. 5¼d., while at Ems it is 8s. 10¼d., per 1000 cubic feet. At Giessen the same quantity costs 8s., at Lippstadt 7s. 4½d., at Wiesbaden and Solingen 7s. 1½d., at Iserlohn 6s. 6¾d., at Mayence 6s. 5½d., at Ruhrort 6s. 5¼d., at Geldern 6s., at Altena, Deutz, Soest, Kreuznach, Coblentz, and Jülich 5s. 8½d., at Crefeld, Neuss, and Herford 5s. 7d., at Siegen, Emmerich, St. Johann, and Eupen 5s. 5¼d., at Hagen, Neuwied, Paderborn, Münster, Bielefeld, Dusseldorf, Cleves, and Barmen 5s. 1¾d., at Osnabruck and Elberfeld 4s. 10¼d., at Galdbach, Treves, and Rheydt 4s. 7d., at Hörde, Oberhausen, Dortmund, Duren, Aix-la-Chapelle, Minden, and Cologne 4s. 6¾d., and at Witten, Wesel, Steele, Unna, Duisburg, Essen, and Mulhiem-on-the-Ruhr 4s. 3½d. Of these 50 towns the gasworks belong to the local corporations in the following 23 instances:—Witten, Unna, Essen, Horde, Dortmund, Duren, Cologne, Minden, Osnabruck, Elberfeld, Paderborn, Munster, Bielefeld, Dusseldorf, Cleves, Barmen, Neuwied, Emmerich, Herford, Altena, Colbentz, Wiesbaden and Lippstadt. The gasworks of the remaining 27 places are the property of private firms or companies. The prices above given are the normal fixed prices, but in 32 of the 50 towns a discount is given to large consumers of gas varying from rather less than 2 per cent. (in Crefeld) to more than 40 per cent. (at Ems). The average normal price in all the 50 places is within a small fraction of 5s. 5¼d. In the 23 towns with corporation gasworks the average price is 5s. 1¾d. per 1000 cubic feet, while the 27 places where the gasworks are in private hands the average price per 1,000 feet is 5s. 8½d. Of the seven places where gas is cheaper (4s. 3½d. per 1000 feet), the gasworks of four (Wesel, Steele, Duisburg, and Mulheim) are the property of private firms or companies, while it is only in the minority of cases (Witten, Unna, and Essen) that they belong to the town authorities.

SANITARY APPLIANCES.—On Saturday afternoon, at the Parkes Museum of Hygiene, in the University College, Gower Street, founded in memory of the late Dr. Parkes, and opened under the auspices of the Home Secretary and Lord Cranbrook, an illustrated lecture was given by Professor Corfield, medical officer of health of St. George's, Hanover Square, to working men of the artisan class, on sanitary appliances and insanitary appliances used in cottages and mansions. The lecturer pointed out the evil results caused by bad, careless, or "scampish" workmanship in the building and repairing of houses. It was a good sign that the working men present entered fully into the considerations placed before them, and studied with evident interest the many points of the lecture. Professor Corfield gave his first chapter on house sewers and the materials of which they should be constructed. Having before him the hard stone ware of Messrs. Doulton, of Mr. George Jennings, the sanitary engineer, and of Messrs. Stiff—all three firm neighbours in Lambeth, and each celebrated for its particular work—Professor Corfield went on to say of what material the house sewers or drains should not be constructed; that no soft materials, as brick or tile, should be used, as they not only gave off through the houses the evil gases which poisoned the blood of the dwellers, but afforded to rats the means of carrying to the food safes directly the seeds of typhoid fever. He urged the necessity for care being taken in the jointing of hardware pipes, which, he insisted, should always be used; and he commended highly some contrivances adopted by the firms named, as their joints did not get out of order. A workman present added that the cost of the new joints would be no more in the end than the imperfect common ones, as by the use of the new ones labour would be saved. On the subject of sinks, the evils of the old systems were placed in contrast with the advantages of the new. Specimens of eccentricity om the part of the British working plumber, as taken out of various houses, were next shown. They mostly consisted of "D" traps, originally placed in houses to prevent he rising of sewer gas; but into them Mr. W. Eassie, the civil engineer, on being consulted abont bad house drainage, had found the workmen had connected the pipes of baths and such-like modern improvements of a house, and so had ventilated the sewers directly into the bedrooms of dwellings. The evils of careless and thoughtless workmanship in the case of plumbing were illustrated in many other cases, and Professor Corfield dwelt upon the principles which should be observed in regard to the sinktraps and syphons placed in dwellings. The lecture ended, the audience warmly thanked the lecturer for the practical information which he had communicated.

RAILWAYS & TRAMWAYS.

New Railway.—The Furness Railway Company propose to construct a new branch railway to Croft Pit, near Whitehaven, with the object of facilitating the transit of coal.

Railway in East Roumelia.—The project of a railway from Jamboli to Burgas, which will connect Philippopolis with the Black Sea coasts, is under consideration, and will be submitted to the Assembly at Philippopolis in February.

The Severn Tunnel Works.—The Great Western Railway Company have entered into a contract with Mr. Walker, well known in connection with the construction of Swansea Docks and other public works of South Wales, for the completion of the Severn tunnel. The estimate is one million and a half sterling.

The Midland Railway.—The directors of the Midland Railway Company have appointed Mr. M. W. Thompson, of Bradford, Chairman of the Company, in place of the late Mr. E. S. Ellis. Mr. Thompson has been Deputy-Chairman for some years, and he will be succeeded in that position by Mr. Kenrick, of Birmingham.

Underground Railway in Paris.—It is proposed to construct a new underground line, one mile in length, from the Place de l'Etoile to the Bois de Boulogne, starting from the corner of the Rue de Presbourg, on the south side of the Avenue de la Grande Armée, and terminating at the Carrefour des Sablons, on the Maillot Boulevard at Neuilly. The line will consist of a single pair of rails, and will be worked by atmospheric power, the air to be compressed by engines placed on the bank of the Seine, near the bridge of Neuilly. Each train will be composed of four carriages to hold 200 passengers, and the time of transit, allowing for stoppage at the intermediate stations at the fortifications, is to be six minutes.

Japanese Railway.—The *Hiogo News* states that the Japanese Government has decided upon at once going on with the construction of a railway between Shiwotsu, at the head of Lake Biwa, and Tsuruga, a town at the head of a large bay, which will probably before long become an open port. Some high officials connected with the Board of Works are to proceed to Tsuruga on this business without delay. It is expected that the opening of the line in question will have a most beneficial effect on the trade of the treaty port of Kobe. A large extent of rich country will be opened up to commence, and it is probable that the whole of the produce of the silk districts to the north of Lake Biwa will be brought to Kobe for shipment to Europe.

Sport by Rail.—An American contemporary says:—Mr. Jerome Marble and party, who on the 2nd of September left Chicago over the Chicago and North-western in Mr. Marble's hunting car, the City of Worcester, have returned. The party have a record which shows that they "bagged" a good deal of game. The record shows that they killed in about sixty days 1,557 prairie chickens, 96 wild geese, 256 ducks, 188 quail, 17 snipe, 9 woodcock, 11 yellow legs, 20 golden plover, 12 jack rabbits, 15 gray rabbits, 7 sandhill cranes, 3 merganser ducks, 1 blue heron, 9 pigeons, 3 deer, 2 badgers, 1 coyote, 3 sharptail grouse, and 1 raven. All the prairie chickens were killed along the Maple River branch of the Chicago and North-western in Western Iowa. As soon as the new hunting-cars of the Chicago and North-western are completed it is expected many hunting parties will take advantage of the opportunity and visit the fine hunting grounds in Western Iowa.

Novel Locomotive.—The *Philadelphia Record* says;—Passengers on the Philadelphia and Reading Railroad have recently noticed a novel-looking locomotive, with the cabin perched away up on top of the boiler, like a saddle on a long-bodied horse. It is not so clumsy-appearing as the old camel-backs which were used on that road for years, but its oddity draws the attention of the traveller. This locomotive is one of the coal-dust consuming engines, of which there are three in use on the road. One is engaged on the Bound Brook division, another on the Germantown route, and a third on the main line in the coal regions. The locomotive has four driving-wheels, each 5 feet 7 inches in diameter, and four track wheels, each thirty inches in diameter. The fire-box is 8 feet long by 4½ feet wide. The engine is capable of a speed of 75 miles an hour, and the peculiarity of construction is rendered necessary because it consumes coal-dust instead of coal. This is a great saving in the item of fuel, and the company is adopting the patent, which is the idea of Superintendent Wootten, to all its engines as fast as possible.

Railway Development in Central America.—The utmost activity is being shown in pushing forward the preparations for the new line across the Isthmus of Tehuantepec, for which the Mexican Government have granted a ninety-nine years' concession. The chief engineer, Mr. Van Brocklin, is already on the spot at the mouth of the Goatzocoalcos River, levelling and grading, preparatory to laying the rails. In Costa Rica, Messrs. Keith and Co. have concluded a contract for the completion of the line between Port Limon, on the Atlantic seaboard, and San José, the capital. A portion of this railway, from Alajuela and Cartago, forty-two miles long, has been open since 1873. It is eventually intended to extend it to the port of Calderas, on the Gulf of Nicoya, on the Pacific side, and this makes a second railway communication between the two seas. In Nicaragua, the works on the railway between Corinta and Moabila, on the Lake Managua, are progressing rapidly; eight miles have been already completed. Convict labour is largely employed, and is found to be very advantageous. It is intended shortly to commence the section between Chinandeza and Leon.

New Railway Stations.—On New Year's Day two new railway stations were opened in different parts of the metropolitan suburbs. The first is one belonging to the Midland Railway at South Acton, between Acton and Turnham-green. The trains between St. Pancras and Earl's Court will stop at it two minutes after leaving Acton on the down journey, and two minutes after leaving Turnham-green on the up journey; and it will afford accommodation to a new and rapidly increasing neighbourhood. The other station to which we refer is at Mildmay Park, on the North London Railway, about equally distant from the Dalston and the Canonbury stations. The trains between Chalk Farm station and Broad Street will stop here both on the up and on the down journey. A new and commodious goods station, erected by the London and North-Western Railway Company, near the Atlantic Docks, at the north end of the Liverpool Dock system, was formally opened on Thursday. The company have now five large goods stations at about equal distances from each other, along the whole line of docks, and the dock rails place them in easy communication with the whole of the docks on the Liverpool side of the Mersey.

Luxurious Railway Cars.—The Ohio Falls Car Company have recently constructed a number of handsome passsenger cars, and their latest triumph is a car for the Des Moines, Adel and Western, which is said to be the handsomest coach for a narrow-gauge road ever built in this country. The car is 40 feet long, with fourteen double windows on each side, and will comfortably seat fifty persons. All the seats are double reversible and entirely new. The whole structure of the seats is in beautiful Eastlake designs, and they are finely carved and penciled. The seats are upholstered with rich plushes in garnet and green. The floor is covered with a fine carpet. The car throughout is of Eastlake and Queen Anne design combined, and is something new. The inside finish shows the richest veneers of fine woods contrasted and all finely carved. The trimmings throughout are Queen Anne in bronze. The lamps are a new pattern, gotten up for this car. The head lining was designed at the works, and is very elaborate, but in perfect harmony with the car. It is painted on canvas especially prepared, and one of the best artists executed the work. The deck lights are white-figured ground glass. The outside of the car is alternate wide and narrow panels below the belt rail. These panels are beautifully painted in mosaic, rich gilding on belt rail, sign-bound corner and door posts. The name is painted in shaded gold letters. The car is ventilated by transoms at the ends, as well as by pivoted sash.

Tramways.—One or two new points of interest may be noted in connection with tramway enterprise. One is that the traffic of the North Metropolitan Tramways Company is officially notified as showing for the past half-year the substantial increase of more than £15,000 over last year. Facts are better than any amount of argument, and a fact like this goes to prove that there reside in tramway traffic combined elements of solidity, progress, and elasticity which will cause them in the future to realise the hopes of even the most sanguine amongst their shareholders. Tramways only want time for development, and some of them seem as though they did not need even that. A second point is the fact that the arrangements between the Corporation of Liverpool and the Liverpool Tramways Company have been finally adjusted, the corporation taking over the tramways on agreed terms and leasing them to the company for a long period of years. The fact is satisfactory on several grounds. (1) It consolidates firmly the position of the company in question. (2) It removes a source of doubt which, as we learn, has weighed upon the tramway market and checked investments in a greater degree than may have been thought; and (3), most important advantage of all, it establishes a valuable precedent, as being the first important instance in which a treaty of mutual agreement and tending to mutual benefit has been concluded between a tramway company and a local corporation, thereby showing the sort of relation which ought to prevail between a body of capitalist-shareholders working good in a place and the executive authorities of the locality.—*Money Market Review*, January 3rd, 1880.

Manchester South District Railway.—The Manchester South District Railway, running between Manchester Central Station and Stockport (Teviot Dale), was opened for passenger traffic on Thursday, last week. The construction of the line was commenced in July, 1877. The increasingly important suburbs through which is passes are Chorlton-cum-Hardy, Withington, Didsbury, and Heaton Mersey. It leaves the Cheshire Lines at Cornbrook, and, passing through a tunnel, some 400 yards long, under the Stretford-road at Old Trafford, and also beneath the South Junction Railway, proceeds to Chorlton-cum-Hardy, and the other places named, at each of which a handsome and commodious station has been erected. Goods stations have also been erected at Chorlton-cum-Hardy and Didsbury. It is intended in course of time to conduct the Midland through traffic between Manchester and London, Derby, Birmingham, Bristol, and all stations in fact upon the Midland system in the south and west of England over the South District Line. This will have the desired effect of relieving the traffic between London-road and Ardwick, which is at present very crowded. The inhabitants of the different places covered by the new line will no doubt very greatly appreciate the facilities which will thus be afforded them of travelling to and from towns far and near. For the present, however, only local trains will be run between Manchester and Stockport, and the through traffic will not be commenced until the new central station is completed or nearly so, as the accommodation at the temporary station in Windmill-street would be far too inadequate for the purpose. Arrangements have been made for running 14 trains each way between Stookport and Manchester on week-days, and three trains will be run each way on Sundays.

ELECTRICITY, TELEGRAPHY

Edison's Telephone.—Edison's telephone has, it is said, been successfully used over a line of 2000 miles in length. A hunting party in Nebraska were thus enabled to converse with perfect distinctness with their friends in Pennsylvania, *via* Chicago and the Western Union Telegraph Company's line.

Aluminium Telegraph Wires.—German telegraphic engineers have lately been experimenting with aluminium as a material for telegraph wires. This metal can easily be drawn out to a much finer gauge than is possible with iron, and its conductibility is twice as great as that of iron wire. Its excessive cost, has hitherto prevented its use for the purpose indicated, but it is found that an alloy of aluminium and iron can be easily made, which will produce a wire both finer and stronger, and less susceptible to atmospheric changes than iron wire, while it is much superior as a conducting medium.

A Novel Use of the Telephone.—Hitherto, says Captain Green, of the United States Ordnance Department, the accurate determination of the time of flight of small-arm projectiles has been practically impossible at long ranges, owing to our inability to see them strike, even when firing over water. The discovery of the telephone has opened up to us a simple as well as a novel means of obtaining the time desired, and has also afforded us the means of verifying the formulas by which these times were formerly adduced. In these experiments, two telephones provided with Blake transmitters (a form of Edison's carbon telephone) were used. One was placed within a few feet of the gun, and left open to receive and transmit the sound of the discharge. The other was in the shelter-proof, which was about 30 feet in front of the right edge of the target. A stop watch, beating fourths of a second, was used in connection with it. The telephone being at the ear, the instant the sound of the discharge was received at the target the watch was stopped. A mean of a large number of observations, which rarely differed more than a quarter to half of a second from each other, gave the time of flight. Of course there is a slight delay in starting the watch, but this is neutralised by a similar one in stopping it. The time given may, therefore, be accepted as strictly correct. It is worthy of notice that the time varies on different days, being shortened by a rear and lengthened by a head wind. The velocity of sound may be readily obtained with the telephone in the same manner. The time for the sound of the discharge passing through the air was always shown by the watch, but as it was not desirable for my purpose to stop the watch until the bullet reached the target, these times were not taken.

NAVAL ARCHITECTURE.

LAUNCHES.

English.

Nora.—On Dec. 22nd, the *Nora* steam yacht was launched bs Messrs. C. Mitchell and Co., on the Tyne. The vessel is to take the place of a yacht of the same name which was wrecked at St. Mary's Island in the spring of last year. The present *Nora* is of considerably increased dimensions, and is as follows:—Length between perpendiculars, 170 feet; breadth of beam, 26 feet; depth, 15 feet. She is to take the highest class at Lloyd's. The engines are by Messrs. R. and W. Hawthorn, of Newcastle, and are constructed on the compound-surface condensing system, and will burn an extremely small quantity of coal, while the vessel, from her fine lines, is being propelled at the rate of 11 knots per hour. The owner is Mons. Perret, a French senator.

Scotch.

Bellver.—On Dec. 22nd, the *Bellver* was launched from the yard of Messrs. James and George Thomson, at Clydebank, Glasgow. She is an iron screw-steamer of 1200 tons and 200 horse-power, built to the order of Mr. Thomas Raison, London, acting for Senor Bauls, of Palma de Mallorca.

Billiton.—On Dec. 29th, Messrs. Blackwood and Gordon launched from their yard at Port Glasgow a screw-steamer of the following dimensions:—Length of keel and forerake, 160 feet; breadth of beam, 25 feet; depth of hold, 9 feet; and the tonnage B.M., 482. The engines, which will be supplied by the builders, are of 75 horse-power nominal, and are compound surface-condensing. The vessel has been built to the order of Messrs. Adamson, Gilfillan, and Co., London, for Lee Keng Yong, of Singapore, and is intended for the passenger traffic between islands around Singapore, and with this object she has been constructed without a keel, so as to enable her to sail in shallow water. As the vessel left the stocks she was named the *Billiton*.

Fantee.—On Dec. 24th, Messrs. Alex. Stephen and Sons launched from their yard at Linthouse the *Fantee*, a twin screw-steamer 120 feet long, built of Siemens' steel, and specially designed for trading in shallow rivers, being capable of carrying cargo on a very light draught. The vessel was fitted before launching with two pairs of compound engines, giving together 50 horse-power nominal.

Lizzie.—On Dec. 19th, the Campbeltown Shipbuilding Company launched from their yard at Trench Point, a cutter of 50 tons, built to the order of J. B. Lindsay, Esq., of Irvine. The vessel was named *Lizzie.*

Resolute.—At Dundee on the 29th Dec., there was launched by Messrs. Alex. Stevens and Sons a screw whaler, named the *Resolute*, whose dimensions are:—Length, 175 feet 9 inches; breadth, 30 feet 8 inches; depth of hold, 18 feet 6 inches; and 680 tons gross. She has been built for the Dundee Seal and Whale Fishing Company, and Captain Yule, formerly of the whaler, *Esquimaux*, has been appointed commander. She is classed A 1 at Lloyd's for ten years. The vessel will be barque-rigged, and will be fitted with engines of 96 horse-power, and also with tanks capable of holding 350 tuns of oil. She, in company with four other of the Dundee fleet, will leave for St. John's, Newfoundland, to prosecute the seal fishing.

Trial Trips.

Grandtully Castle.—The new screw-steamship *Grandtully Castle*, of 3600 tons, built by Messrs. Barclay, Curle and Co., Glasgow, for Messrs. Donald Currie and Co., of London and Leith, went down the Clyde 31st Dec, on her official trial trip. The vessel ran the measured mile below Wemyss Bay, making 14¼ knots, equal to 16½ English miles, with 61 revolutions per minute, and a pressure of steam of 75 lb. It was remarked that the speed attained is within a fraction of that made by the steel ship *Kinfauns Castle*, also belonging to Messrs. D. Currie and Co.

Mayo.—On Saturday last the steamship *Mayo*, built by Messrs. Oswald, Mordaunt and Co., Southampton, went on her trial trip. Her dimensions are:—Length between perpendiculars, 240 feet; beam, 33 feet; depth in hold, 18 feet 2 inches. She is constructed with a long quarterdeck, and has about 450 tons of water ballast, partly in double balance. The engines are compound surface-condensing of 135 horse-power nominal, with one large double ended boiler. The speed attained on the measured mile was 10·2 knots. The dead weight of the *Mayo* will be about 1900 tons, and she is classed 100 A 1 in Lloyd's, and has a complete iron upper deck in addition to Lloyd's requirements. She is built to the order of C. W. Pollexfen, Esq., of Liverpool, and is intended for general cargo trade. The vessel and machinery was designed and built under the superintendence of James Rode, consulting engineer and naval architect, Liverpool.

THE ONLY IRON CLIPPER UNDER THE AMERICAN FLAG.—The iron clipper ship *Mariposa*, Sutton and Co.'s line for San Francisco, is a novelty in marine architecture. She enjoys the distinction of being the only iron clipper ship under the American flag. She was built in England, but was wrecked near San Francisco, and sold "on account of whom it may concern," George Howes and Co. becoming the purchasers. She was given a new name, and a new register was taken out under the American flag. The iron plates used in her repair were sent out from New York by Mr. Roach. At the American Lloyd's she rates A1, twenty years.—*Iron Age.*

NEW FERRY ON THE MERSEY.—A new landing-stage, ferry buildings, and approaches, which have been constructed at Seacombe, between Birkenhead and New Brighton, on the Cheshire shore of the Mersey, at the cost about £150,000, were formally opened on Monday. The improvements include a river wall of over 1000 feet in length, by which 18,329 yards of foreshore have been reclaimed. There is a handsome ferry station. Two piers extend 80 feet into the river (one for goods and the other for passengers), and from each pier a bridge leads to the landing-stage, which is 315 feet long by 80 feet wide. The passenger bridge has a glass and iron roof. The improvement at the ferry was much needed, the old landing-place being very inconvenient and uncomfortable; but while the works have been in progress since 1876, a good deal of exceptional inconvenience has been experienced.

THE NEW DOCK AT MARYPORT.—The contract for the construction of the new dock at Maryport has been let to Messrs. Doherty and Co., of Dublin, the agreement having been signed last week. The original tender sent in by this firm was £91,306, but it has since been reduced to £91,006, owing to some alterations in the dock-basin, as suggested by the engineers. The works are to be completed in two years, and operations are to be forthwith commenced. The dock will possess advantages over other docks in the district, inasmuch as it will have 5 feet more depth of water on the sill, and thus be adapted for a larger class of vessel. A dock of large dimensions, and capable of accommodating large vessels has been required at Maryport for a considerable length of time, to suit the wants of a growing trade in iron and steel. The trustees have borrowing powers to the extent of £100,000, and it is expected that they will be able to complete the work for this money.

THE NEW BREAKWATER NEAR PLYMOUTH.—The new breakwater for the protection of the Cattewater and Sutton Harbour, which is being made from Batten point by the Cattewater Harbour Commissioners, is progressing very satisfactorily. Of the 915 feet, which is to be the full extent of the breakwater, 715 feet have now been completed; while 70 feet further of the basement and the foundations have been laid for a length of 770 feet. The foundations are now made about 20 feet under low-water mark, divers first laying down bags of concrete. When a level surface has thus been made, large concrete blocks, varying in weight from 9 to 14 tons, are placed upon them. These blocks form the retaining walls, and rise 3 feet or 4 feet above high water. The space between is filled with broken rock from Mount Batten, and the whole is surmounted by a parapet. The estimated total cost of the work, which has now been in progress a year and nine months, is £25,000.

RUSSIAN DOCKS.—Messrs. Clark, Standfield and Co., of the Millwall Ironworks, have just entered into a contract with the Russian Government for the construction of additional pontoons, by which the docking power of the Depositing Dock at Nicolaieff will be considerably increased. This dock was, in the first instance, constructed of sufficient power for docking vessels of any beam up to 150 feet, and of 4400 tons dead weight, this power being more than enough to dock the largest and heaviest vessels of the Black Sea fleet. By this addition, the dock will be made capable of docking and depositing ironclads or other vessels of 6000 tons dead weight. The Czar's new imperial yacht, now being built on the Clyde, has a beam of 150 feet (that is, twice the beam of the broadest vessel in the British Navy), so that the Nicolaieff Depositing Dock is the only one in existence able to accommodate her. A full description of this dock will be found in our issues for August, 1877.

THE EXPERIMENTAL BUOY ON ROSENEATH SHOAL, FIRTH OF CLYDE.—The light on this buoy was again extinguished on Friday night last week, about nine o'clock, during a severe squall of wind accompanied with drenching rain. The buoy, which is lighted with gas, was placed upon this dangerous patch about a fortnight ago, and up till Saturday se'nnight it proved a great success; but during the gale which prevailed on that night the light was blown out. Last week it was relighted, an additional supply of gas being given in order to strengthen the flame in the lantern. On Friday afternoon a fearful squall of wind and rain passed over the anchorage at the Tail of the Bank, and when the weather cleared the light was seen to be burning. It was then considered capable of outliving any storm; but about nine o'clock, another heavy squall prevailed, and the light was then blown out. On Saturday it was relighted, and has since continued to burn all right. A suggestion has been made that in the event of the weak point in the lantern's construction being mastered, all the buoys from the Tail of the Bank to the Broomielaw should be similarly lighted, such an arrangement being likely to prove a great boon to river navigation.—*Glasgow Herald.*

ROYAL NATIONAL LIFEBOAT INSTITUTION.—On Thursday last week a meeting of the Institution was held at its house, John Street, Adelphi, Mr. Thomas Chapman, F.R.S., vice-president, in the chair. There were also present the Marquis of Cholmondeley, Mr. George Lyall, Sir Edward Perrott, Colonel the Hon. C. F. Crichton, Captain Evans, R.N., C.B. (Hydrographer to the Admiralty), Admiral Phillimore, Mr. George Palmer, Admiral M'Hardy, Admiral Ward, and Mr. R. Lewis. The minutes of the previous meeting having been read, the thanks of the Institution, inscribed on vellum, were presented to Mr. Dennis Connor, chief officer of Her Majesty's Coastguard at Rosslare, Ireland, in acknowledgment of his zealous co-operation on the occasion of the Carnsore lifeboat going out on service on the 28th ult., when he formed one of the crew of the boat. On a subsequent occasion the same lifeboat was the means of saving the crew of 12 men and a pilot from the barque *Cheverine*, of Havre, which had stranded in Churchtown Bay in a strong wind and heavy sea, the rocket apparatus having previously been unable to effect a communication with the ship. The *Caister* lifeboat, in perilous circumstances, saved the crew of eight men from the brig *Rival*, of Blyth, which was wrecked on the Cross Sands in a heavy sea. The *Palling* lifeboat assisted to save the barque *Onward*, of London, and her crew of 16 men; the vessel had been ashore on the Leman and Ower Sands and was very leaky. The *North Deal* lifeboat also performed a gallant service in the rescue of 19 men from the ship *Leda*, of Bremen, which had gone on the Goodwin Sands during a gale of wind from the south-west; so heavy was the sea running on the sands at the time that the men had much difficulty in preventing themselves from being washed out of the boat. The silver medal of the Institution was voted to Lord Dunmore, and £5 to three fishermen who put off with him in an open boat and proceeded at 1 o'clock in the morning a distance of 11 miles through a very heavy sea to the rescue to the passengers and crew of the yacht *Astarte*, who had taken refuge on a small island in the Sound of Harris during a south-westerly gale on September 22. The long and valuable services of the coxswains of the lifeboats at Margate and Newbiggin (Northumberland), on their retirement from duty, were also additionally acknowledged by the Institution. Payments amounting to £2050 were made on the 269 lifeboat establishments of the Institution.

CLYDE SHIPBUILDING IN 1879.—The returns of the tonnage of vessels launched on the Clyde during the year drawing to a close show a falling off compared with 1878 of 49,150 tons, but compared with 1877 an increase of 3493 tons. This state of matters is sufficiently accounted for by the great depression which prevailed during the first ten months of the year. During the last two months the prospects have greatly brightened, and at the present time there is a large amount of work on hand which will materially affect next year's figures. The total number of vessels launched on the river during the year was 170 of an aggregate tonnage of 173,438 tons, as compared with 236 vessels and 222,353 tons in 1878. One feature of the work of the year has been the number of steel-built vessels launched, which have reached an aggregate of 18,808 tons. Messrs. Denny and Brothers, of Dumbarton, have built no fewer than ten of these ships. These included a steamer of 4000 tons for Messrs. J. and A. Allan's Transatlantic service, and two steamers for the Union Steamship Company of Australia of 1728 and 1653 tons respectively. Messrs. John Elder and Co. built for Messrs. Donald Currie and Co.'s Cape Mail service a steel vessel of 3000 tons; and Messrs. R. Napier and Sons, Govan, two steel steamers of 2520 tons each for the Pacific Steam Navigation Company. Several important additions were made during the year to the great ocean-carrying companies. The chief of these were the *Orient*, 5386 tons, for the Orient Steam Navigation Company, and the *Arizona*, 5,147 tons, Guion Line. Both these vessels were built by Messrs. John Elder and Co., Govan. During the last two years several vessels of large dimensions have been constructed on the Clyde, while other monster ships are either in the hands of builders or are being planned by naval architects. Competition amongst the great line of ocean steamers has of late become excessively keen, and there is an evident desire on the part of shipowners to outstrip each other in the dimensions of their vessels. Whatever qualifications must be possessed by the ocean steamships of the immediate future, it is interesting to note that great size is likely to be one of their characteristics. A few details regarding the large vessels recently built, and, for the sake of comparison, the largest ship afloat (the *Great Eastern*), will be of interest at the present time. Last year Messrs. J. and G. Thomson, Clyde Bank, built the *Gallia*, a Cunard Liner, of the following dimensions:—Length over all, 450 feet; breadth, 44 feet; depth, 36 feet. The tonnage of the *Gallia* is 5200 tons. During the present year Messrs. John Elder and Co., Govan, completed two large, powerful steamers, each over 5000 tons. The *Arizona*, built by Messrs. Elder and Co., for the Guion Line, is 465 feet long, 46 feet broad, and 37 feet in depth, her tonnage being 5300 tons. She is capable of carrying a dead weight of cargo, exclusive of 1200 tons of coal in the bunkers, of 2600 tons. The second large vessel built this year by Messrs. Elder and Co. was the *Orient*, a steamer of the following dimensions:—Length 460 feet; breadth, 46 feet 6 inches; depth, 37 feet 8 inches; tonnage, 5386 tons. The *Orient*, which is the largest vessel ever launched on the Clyde, has a displacement at load draught of over 9500 tons. But the Cunard Company are having built for them by Messrs. J. and G. Thomson, Clyde Bank, a steamer larger than either the *Arizona* or the *Orient*, and exceeded in size by the *Great Eastern* only. The new vessel will be 7500 tons and 10,000 horse-power, her dimensions being 500 feet in length, 50 feet in breadth, and 41 in depth. No sooner had the Cunard Company announced their intention to build a vessel second in point of size to the *Great Eastern* only than the Inman Company determined to add to their Transatlantic service a steamship of even still larger dimensions. The contract for the new new Inman Liner has not yet been closed, but we understand that it has been resolved to have it built at Barrow, and that it is to be an 8000-tonner. The length of the *Great Eastern* on load water-line is 680 feet, breadth extreme 82 feet 6 inches, and her depth at the side is 58 feet. Her tonnage, according to builder's measurement, is 22,627 tons; her register tonnage, including engine space, is 18,914 tons; and her register tonnage, excluding engine space, is 13,343 tons. She has stowage for cargo to the extent of 6000 tons, and the capacity in her coal bunkers is 10,000 tons. Her draught of water light is 15 feet, and her water draught loaded is 30 feet. The displacement of the vessel when light is 11,844 tons, and her displacement loaded is 27,384 tons. She has accommodation for 800 first-class, 2000 second-class and 1200 third-class passengers, but if required for troops alone she could carry 10,000 men. It will thus be seen that the *Great Eastern* is in point of size considerably ahead of anything yet ventured by shipowners, and though there is an evident desire to increase the size of the great ocean steamers, the position of Mr. Scott Russell's ship as the largest afloat is not likely to be disputed.

ARMS, ARMOUR AND EXPLOSIVES.

NOVEL GUNNERY TRIAL.—Major-General C. W. Younghusband, C.B., Royal Artillery Superintendent of the Royal Gun Factories, Royal Arsenal, Woolwich, has gone to Italy to witness a gunnery trial of a novel and interesting description, the gun being one of 100 tons weight, but made of cast iron instead of the wrought iron or steel, which modern artillerists regard as indispensable for heavy weapons if they are to fire large charges. The strain to which this cast iron piece of ordnance will be subjected is not stated, but the gun is described as strengthened with hoops of steel, and theoretically capable of great endurance.

CONVERSION OF A WOOLWICH PATTERN-GUN.—One of the Woolwich pattern guns converted into a breech-loader for experiment has been conveyed to Shoeburyness for long-range practice. The breech apparatus is on the screw principle, adopted for the breech-loaders now in course of manufacture. It is also proposed to send to Shoeburyness two other converted breech-loaders—one a 40-pounder Armstrong with the trunnions turned so as to place the wedge at the side instead of the top of the piece to allow of its being easily drawn out, and the other a 31-pounder cast-iron gun altered in imitation of the Krupp system. These guns have all been tried at Woolwich, and the superiority displayed by the first-named has induced the Ordnance Select Committee to recommend its adoption as the pattern of the new service weapons.

BREAKING ICE WITH DYNAMITE.—Some experiments of this order were recently made on the Seine, near the Pont des Invalides, in presence of a large crowd massed on the quays. Two civil engineers, MM. Bernard and Lay, directed operations, and they were aided by MM. Flegy and Streits, of the Nobel Dynamite Company. The experiments were six in number. In the first, a cartridge of 80 grammes on a float placed in a hole of 20 centimetres diameter, was exploded with a Bickford fuse; it enlarged the hole 75 centimetres, and cracked the ice to a length of 6 metres. The second cartridge, of 250 grammes, placed similarly under the ice with a Bickford fuse, projected vertically to a great height a mass of water and *débris*, and dislodged nearly 100 cubic metres of ice. The third experiment, which was the most important, was made with three cartridges of 406 grammes, each connected by conducting wires with an electric machine on the bank. The portion of ice shattered was about 80 metres long by 5 to 6 metres broad. This experiment seems to have indicated the right way to follow, for not only was a large quantity of ice separated from the mass, but it was in very small pieces; this would obviate agglomeration against the arches of bridges. The three remaining experiments were made with cartridges of 400 grammes, exploded with the Bickford fuse. The dislocations were about 15 to 20 metres in extent, which can be doubled by introducing levers into the fissures produced by the explosion.

GUNNERY EXPERIMENTS.—Sir W. Palliser writes to the *Times*:—"It may be interesting to some of your readers to know that my rifled 64-pounder gun of 58 cwt. has been disabled by a double charge—namely, by 6 lb. of R. L. G. powder and a 66 lb. shot rammed down on 6 lb. of similar powder and a similar shot. The powder acted with exceptional violence. Some of those present considered that it had 'detonated.' However this may be, the barrel of the gun, though much bulged, is sound, while the casting or shell of the gun is cracked in several places. The thickness of the gun round the front charge is equal to the diameter of the bore. During a previous trial the same effect was produced upon a similar gun by a charge of 30 lb. of R.L.G. powder and a shot of 150 lb. weight. In fact, the same barrel has been used in each of the guns. The disabled gun is now being bandaged up with an iron hoop, and will shortly be fired with papier-mâché wads to try the effect of jamming. I submit that one more instance has now been added to the proofs which have gone before that guns which are lined with coiled wrought-iron barrels do not burst, but only become disabled when subjected to excessive strains; and I feel convinced that the substitution of these barrels in the place of steel tubes would prevent any chance of wrought-iron guns being burst in similar circumstances. Looking to the fact that the action of gunpowder is much affected by various circumstances, and that in order to keep the pressures in large guns within due bounds it is actually necessary to make up the cartridges in a peculiar manner and to employ powders of different natures for different guns, it will be seen how difficult it may be to prevent the occasional occurrence of exceptional pressures in large guns. The question is thus one of great importance, and it will, no doubt, receive the attention it deserves." In a subsequent letter to the same journal, Sir W. Palliser adds:—"I should feel obliged if you would allow me to contradict an announcement which has recently appeared in most of the London papers to the effect that I instituted my experiments to oppose the opinion of the *Thunderer* Committee. I need hardly, I hope, say that my only object is to seek for the truth. I have now before me carefully prepared diagrams, showing the enlargements of the bore caused in one gun by four, and in the other by eight rounds of double charges. In no case has the rear charge of powder caused the slightest expansion in the bore; whilst the expansions which have been caused by the front charge show that the pressures with pebble powder have been very great, and that the pressure due to the R. L. G. powder has been exceptionally violent. I have, therefore, much pleasure in correcting a former opinion which I had formed upon the results of experiments made with muskets, and in stating that the opinion expressed by Captain Noble, and adopted by the *Thunderer* Committee, is correct as regards the pressure of a forward charge. I am, however, still of opinion that the bursting of the 38-ton gun has been due to a jam, and not to double-loading, and for the following reason:—In every case out of 12 rounds with double charges the point of maximum pressure caused by the front charge of powder lay over that charge, and in rear of the base of the front projectile; while in the *Thunderer's* gun the point of *maximum* pressure was situated in front of the place where the base of a front projectile would have been had there been one in the gun. As I have been frequently asked whether I believe that double-loading would burst the *Thunderer's* gun, I should like to say that, if the gun were double-loaded, so that the front charge should lie in the position in which it was painted upon the outside of the burst gun, I think it would probably burst; but if the charge be rammed well home, then the front powder-charge will come within the coiled breech-piece, and the gun must be a worse gun than I believe it to be if it bursts. I submit that my experiments entitle me to say that a 38-ton gun made upon my plan would not burst under either of the above conditions."

CORRESPONDENCE.

THE TAY BRIDGE DISASTER.

To the Editor of IRON.

SIR,—With reference to Mr. Stewart's letter in your issue of the 2nd inst., I hardly think his suggestion (although no doubt practicable in some cases) would be a sufficient safeguard against similar accidents generally. The Tay Bridge disaster is a fair illustration of what I mean, for supposing the girders of the Tay Bridge to have given way before the train was actually on them (as is supposed by some who witnessed the accident), no electric arrangements, as suggested by Mr. Stewart, could have possibly prevented the accident, the train having gone too far on to the bridge to have allowed of its being stopped by signal or other means.—I am, &c.,

A. E. W. GWYN.

31, Palace Road, Upper Norwood.

NOTICES OF NEW BOOKS.

A Treatise on Fuel, Scientific and Practical. By ROBERT GALLOWAY, M.R.I.A., F.C.S., &c. London: Trübner and Co. 1880.

THIS volume is founded on a course of lectures delivered by the author during his professorship in the Royal College of Sciences, Dublin, and is intended for advanced students and for manufacturers. It is, perhaps, not difficult to trace the part which was originally published in the lecture-room, and which shows that Professor Galloway possesses the rare art of popularising science; but that elementary portion has been supplemented by much valuable matter of a more practical character, and the resulting handbook cannot fail to be useful to all to whom its subject is of interest, either theoretically or economically. All the substances employed as fuel consist almost wholly of woody tissue, the tissue of recent vegetation being unaltered, and that in peat and the different varieties of coal being in a more or less altered form. Recent timber, and even the stems of grasses, are employed to a considerable extent, in this and other countries, to produce motive power; peat is less frequently used, and it, as well as coal, is employed in the production of charcoal or coke. The former, however, cannot be economically substituted for coal in this country, owing to its bulky nature and the quantity of water it retains, even after being thoroughly air-dried. The most important of all fuels, coal, varies very much in character. Some of it approaches very closely to recent wood; other varieties, again, contain so much extraneous matter, as, for example, the Torbane mineral, that their right to be called coal is disputed. Even the most bituminous coals differ in composition so greatly that for important manufacturing purposes some of them are almost as valueless as peat. Coking coal, for instance, is inapplicable for many furnace operations from its choking up the bars and thus impeding combustion, and where coal contains much pyrites, besides other drawbacks, it corrodes the furnace bars. Lignite is a late deposit, varying in physical character from that of the more compact peats to that of the bituminous coals, which are the most valuable and abundant of all. These, again, are divided into caking or coking, and free-burning coals. Cannel coal, to which division the Torbane mineral already referred to belongs, contains a large proportion of hydrogen and other volatile matter. Anthracite, which is found in the lowest portion of the carboniferous formation, is a species of natural coke, containing 90 per cent. or more of carbon. Coal always contains in its pores a variable quantity of gas. That in the Welsh steam-coal is highly inflammable, and evolved to a great extent after the coal has been raised, hence the danger of carelessly shipping it. The decomposition, which allows the gas thus to escape, has been generally attributed to the oxidation of iron pyrites contained in the coal. Professor Galloway agrees with Dr Percy that it is rather due to the oxidation of the organic substances of the coal itself. Chapter II. is devoted to an elaborate exposition of the methods employed for determining the heating power of fuel, and the instruments used for that purpose; and the author afterwards shows that from causes specified the total theoretical heating power is never obtained in practice. In the two succeeding chapters the principles of construction of pyrometers and Siemens' regenerative gas-furnaces are lucidly described, the technical examination and analysis of coal are explained, and a description of Orsat's gas apparatus is given, with the tables employed in calculating the results.

A Treatise on Mountain Roads, Live Loads, and Bridges By LIEUT.-GEN. H. ST. CLAIR WILKINS, R.E. London: E. and F. N. Spon. 1879.

THIS very exhaustive treatise is printed at Bombay, and the illustrations are taken from Indian constructions. In countries like Hindostan, where railways must always be chiefly main lines, roads are necessary not only for local intercommunications, but as railway feeders. These are either ordinary or mountain roads. The principles of construction of the former have been pretty well ascertained; but that is not the case with the others which have been rarely made according to any fixed principles. These the author proposes to supply. The first step is to reconnoitre the site of the proposed road, the plan of which varies according as it is to traverse an approximately level, undulating or mountainous district. For this full and judicious directions are given, and then for the detailed survey. The various classes of road are next defined, their several breadths indicated, and the mode of construction described. Their maintenance and repair form the subject of a separate chapter, and the cost of roads of each class and crossing various descriptions of country is elaborately investigated. Live loads are next examined and compared, and examples are given of the different live loads on trussed girders, which the author considers well suited for road works in a forest country; but he holds that an iron bridge should never be erected where the conditions for a masonry one are suitable, the latter being cheaper and more permanent. Copious and comprehensive as this work is, the author informs us that it is not a mere compilation, but that the opinions expressed and the designs given are the results of his personal experience. That must have been an extensive and useful one; and by putting it thus on record he has rendered an important service to the public as well as to those who may be called upon to perform similar tasks. The volume is illustrated by a score of full-page cuts, showing sections or elevations of roads and bridges.

History and Mystery of Precious Stones. By WILLIAM JONES, F.S.A. Richard Bentley and Son. 1880. Pp. 376.

THE vulgarisation of precious stones is one of the most difficult tasks which the restless levelling spirit of the nineteenth century has set itself. If, as yet, it seems to be weaving a rope of sand, like Michael Scott's indefatigable familiar, there is no denying the fact that progress of an amazing character has been made in mineralogical synthesis. French skill has reproduced meteoric ironstone, pyroxene diopside has been got from the "Thomas" basic brick, garnets and rubies have been made in the laboratory, and the secret of crystallising carbon is said to have been so shrewdly guessed at that the incubation of diamonds will by and by be as common an industry at Glasgow as sugar-boiling. For the present, however, the romance of gems is safe from the spoiling hand of the manufacturer, if, as we desire to do, we may repose our faith on Dr. Percy's assurances, and continue to believe in the inimitable perfection of Nature's workmanship.

On the eve of Mr. McTear's revelations, however, the publication of the present work has a certain appropriateness of contrast which gives its reading an extra piquancy. All the old superstitions connected with gems are recounted, the colouring is shown which they have given to poetry and romance, to religion and to history. Leaving to the mineralogists all scientific detail, Mr. Jones has occupied himself with the archæology and the romance of gems, and has brought together and admirably classified a vast amount of scattered, often recondite, facts and fictions concerning these "flowers of the mineral world." The style is pleasant and gossipy, neat withal, and elastic enough to bear the weight of the erudition it often has to carry. The chapter devoted to the "philosophy" of gems is not the least entertaining; we are sorry, however, that it leaves undiscussed the momentous question, May a gentleman, or may he not, wear a diamond ring?

The Journal of the Iron and Steel Institute. No. 2. 1879. London: Spon.

WE have a suggestion to make to the Iron and Steel Institute with reference to its reports. The suggestion is to issue the reports as bound volumes. Old-fashioned societies, founded in the days when there was no binding possible unless it was in solid calf, may be excused for standing on their former paths, but a modern and wealthy society would do itself honour by making a handsome appearance in its "Acta." And each issue, in any case, should be complete in itself. This latter point we do not urge, as its advantages are big enough to speak for themselves. And while we are looking round the volume, we may as well say that the lithographic plate, illustrating Mr. Ratliffe's paper on the manufacture of large forgings, will not for one moment compare with the exquisite plates, printed in Leipzig, with which Professor Kerpeley's pamphlet on the structure of various steels was both illustrated and adorned, while any comparision at all with the elaborate coloured engravings which accompanied Marten's microscopic investigations into steels, referred to in the Journal, is not to be thought of. The exercise of our candour in pointing out English shortcomings, contrasted with foreign thoroughness, is painful to ourselves; but we should do little good in blinking the former—that has been done too much—or in pooh-poohing the latter. We have pooh-poohed some millions sterling already into foreign pockets. The larger half of the Journal is naturally occupied by the papers read and discussions held at the Liverpool meeting—and are not these to be found in our own foregoing volume? Mr. Jeans has added hereto, however, a miscellany of useful and neatly-arranged notes *de omnibus rebus* concerning iron and steel, keeping together in one place a number of scattered facts to which easy reference will at times be valuable. We are ourselves only three weeks ahead (in our last number) of his notes on the progress made by the dephosphorisation process. The obituary notices might possibly, we think, have been extended, without snatching too many bodies from Mr. Forrest; but we counsel the entire suppression and hiding away of Appendix II. *Verbum sap.*

Africa: Past and Present. By AN OLD RESIDENT. London: Hodder and Stoughton. 1879.

AFRICA, the mysterious Continent, has from the earliest times been an object of curiosity and interest to the rest of the world, a curiosity and interest which are at least as powerful as ever, even when so many of the difficult problems connected with it have been solved. It is probable that as time wears on and the avenues of trade with the interior are opened, the knowledge not less than the wealth of the world will thereby be greatly extended. Africa is probably the oldest land on the earth, and while rich in mineral wealth, it is no less a teeming mother of vegetable and animal products, specifically multitudinous and differing from those of the other and more widely explored continents. The book is to a great extent a history of discovery in Africa, from the earliest period and brought down to the most recent times, and it contains besides a large amount of geographical information, which cannot fail to prove instructive generally and of special service to traders, emigrants and others to whom reliable information of that description is of essential importance. Considerable prominence is given to missionary enterprise, especially in the Southern division of the Continent; and the volume contains a good map of Africa and a number of excellent full-page illustrations.

NEW BOOKS.

The Crayfish: an Introduction to the Study of Zoology. By T. H. Huxley. Large paper edition. 8vo. Paul and Co.

Lectures in the Science of Language. By MaxMuller. New edition 2 vols. Crown 8vo. Longmans.

Eyesight, Good and Bad: a Treatise in the Exercise and Yreservation of Vision. By R. B. Carter. Crown 8vo, Macmillan and Co.

The Trade of the World: our present System of Commerce Examined. By R. G. Webster. 8vo. Bogue.

A Treatise in the Coins of the Realm. By the Earl of Liverpool. 8vo. E. Wilson.

The Larvæ of British Lepedoptera, and their Food Plants. By O. S. Wilson. Crown 8vo. L. Reeve and Co.

The Spectroscope in Medicine. By C. H. MacMunn. 8vo, Church and Co.

Aids to Materia Medica and Therapeutics. By C. E. A. Semple. Part 2. Foolscap. Bailliere.

The Stars and the Earth. New edition, with notes by R. A. Proctor. Foolscap. Bailliere.

Experimental Researches in the Regional Temperature of the Head. By J. L. Lombard, M.D. 8vo. Lewis.

Two Lectures in South Africa. By J. A. Froude. 8vo. Longmans and Co.

The Need of Protection. By A. MacEwer. 8vo. Bentley.

Adcock's Engineer's Pocket Book for 1880. 12mo. Simpkin and Co.

BOOKS RECEIVED.

A Guide for the Electric Testing of Telegraph Cables. By Captain V. Hoskiær. Second Edition. London: E. and F. N. Spon.

Patent Law and Practice; with a Chapter on Patent Agents. By A. V. Newton. London: Trübner and Co.

Africa: Past and Present. By an Old Resident. Map and Illustrations. London: Hodder and Stoughton.

The Mechanical Theory of Heat. By R. Clausius. Translated by W. R. Brown. M.A. London: Macmillan and Co.

The Year Book of Facts in Science and the Useful Arts for 1879. By James Mason. London: Ward, Lock and Co.

OBITUARY.

The death is announced of Dr. Alexander Sadebeck, of Kiel, professor of mineralogy and geology at Kiel University, on December 9, 1879, at the early age of thirty-six years.

The death of the late Mr. Parry, of Sleaford, Lincolnshire, has caused heartfelt regret in South Yorkshire, where he was known as a kind and generous coalowner, being one of the principal owners of the Stratford collieries near Barnsley. For a series of years the late gentleman was held in the highest possible esteem by his workmen, whom he in conjunction with the other partners provided with a free trip to London. Although the management was vested to a great extent in the hands of Mr. Miller, the manager, Mr. Parry has often met the men, and has been well received. A few years ago the workpeople presented the late Mr. Parry with a beautifully illuminated address, and they are wishful to send a number of their body to Sleaford when the interment takes place.

FACTORY NOTES.

The Tin Trade.—On Monday the Cornish smelters advanced tin standards £3 per ton. Standards now are—superior common, 87s., and superior fine, 88s. per cwt.

Messrs. Justin Brothers, Sheffield.—Mr. Wilfred A. Matthews has been admitted a member of this well-known firm, which will hereafter be known as Justin Brothers and Matthews.

Workington Iron Works.—The furnaces at these works, which recently passed into the hands of a new company, have been prepared during the past few weeks for smelting operations, and it is anticipated they will be ready for lighting in a few days. The company have secured large orders.

Manganese Bronze.—In the article on "Manganese Bronze," which appeared in Iron of December 26, 1879, it is stated that Mr. P. M. Parsons took out the patent for this material in the early part of the year 1866, or nearly fourteen years ago. This is a mistake arising from a typographical error. The date of the patent is February, 1876.

The Tin-plate Trade.—At a meeting of the representatives of the chief tin-plate works of South Wales, held at Gloucester on Wednesday, it was unanimously decided that in consequence of the rapid advance in value of hematite and other materials—the former from 50s. to 120s. per ton since August last—tin plates should be fixed at 30s. per box in Liverpool.

Failure at Manchester.—A petition for liquidation has been filed in the Manchester County Court by Mr. William Harrison, of Portland Street, Manchester, machinist. The liabilities are estimated at £3000. Upon the application of Messrs. Addleshaw and Warburton, solicitors under the petition, the court has appointed Mr. James Eckersley, secretary of Creditors' Association, receiver of the property and manager of the business.

Boiler Insurance.—The contract for the insurance and inspection of the boilers belonging to the iron department in use at Woolwich Arsenal, and the various manufacturing establishments and barracks throughout the United Kingdom, numbering over 300 boilers has again been granted for three years to "The Boiler Insurance and Steam Power Company," of Manchester. Mr. Niel McDougall, late Admiralty Inspecting Officer, is now Chief Engineer of this company, which has already held the above contract for three years.

South Kensington Museum.—Visitors during the week ending 3rd January, 1880:—On Monday, Tuesday, Wednesday, and Saturday (free), from 10 a.m. to 10 p.m., Museum, 14,715; Mercantile Marine, Building Materials, and other Collections, 3,377. On Thursday, and Friday, (admission 6d.) from 10 a.m. till 4 p.m., Museum, 886, Mercantile Marine, Building Materials, and other Collections, 113. Total, 19,091. Average of corresponding week in former years, 27,440. Total from the opening of Museum, 18,628,687.

South Lancashire and Cheshire Coalowners' Association.—The monthly meeting of the members of the above association was held on Tuesday in the Queen's Hotel, Manchester—Mr. Edward Pillington, the president, in the chair. The chief question discussed had reference to the want of proper dock accommodation for the coal trade at Liverpool, and the necessity for increased accommodation at Springs Branch, near Wigan, with regard to which complaints had already been made to the London and North-Western Railway Company.

The Coal and Iron Trades.—On Tuesday Messrs. Bell Brothers instructed their officials at Tursdale Colliery to relight 47 coke ovens. These, with those already burning, will give employment to about 400 hands, and the prospect of a continunace of good trade is evident. At Trimdon Grange over 400 miners are working night and day, and at Trimdon Chilton Collieries double shifts are working, and men are being set on every day. Tudhoe Grange Ironworks are going full time, and puddlers are being fast re-engaged. Good orders for limestone are on at Mainsforth and Rosedale Quarries.

Importation of Foreign Ore.—The scarcity of hematite iron ore in the North-west of England, owing to the large delivery engagements entered into by raisers of the raw material, has necessitated, on the part of the smelters in the district, the purchase of large consignments of Spanish ore, and Irish ore, two orders alone for the former represent 50,000 and 30,000 tons, and this is to be imported at Barrow and other ports during the year. It is worthy of remark that the scarcity of iron ore in Furness and Cumberland is not owing to the mines being exhausted, because such is not the case, as recent explorations prove that large deposits of metal exist in new districts, and are ready at any time to be worked; but the depressed times through which we recently passed had the effect of causing a large number of miners to emigrate, and there are not now so many persons employed in mining in the district as in the brisk times of 1872 and 1873.

Manchester Steam Users' Association.—At the last ordinary monthly meeting of the Executive Committee of this Association, held at the offices, 9, Mount Street, Albert Square, Manchester, Mr. Lavington E. Fletcher, Chief Engineer, presented his Report, which gave particulars of visits of inspection, and a record of boiler explosions, from the 27th of September to the 21st of November inclusive. Of this Report the following is an abstract;—From the 27th of September to the 21st of November inclusive, 880 visits of inspection were made, and 1577 boilers examined—1171 externally, 12 internally, 9 in the flues, and 385 entirely; while, in addition, 12 boilers were tested by hydraulic pressure. Three of these hydraulic tests were applied to boilers that had been already in use, to ascertain their fitness for the pressures proposed to be carried; while in the other 9 cases the boilers were new ones, and were tested not only by hydraulic pressure, but also specially examined both as regards their construction and complement of fittings, before leaving the maker's yard. During the above period, the following defects were met with:—Furnaces out of shape, 4; fractures, 7; blistered plates, 8; internal corrosion, 36—1 dangerous; external ditto, 38—1 dangerous; internal grooving, 24; feed apparatus out of order, 1; water gauges ditto, 1; safety valves ditto, 4—3 dangerous; pressure gauges ditto, 42; boilers without blow-out apparatus, 4; without feed-back pressure valves, 5; cases of over-pressure, 6; cases of deficiency of water, 1. Total: 181 defects—5 dangerous.

NEW COMPANIES.

Aberystwyth Marine Assurance Association.—This is an association for the mutual assurance of ships, belonging to members, or in which members are interested. It was registered 29th ult. as a company limited by guarantee to £2 each member.

Associated Mineowners.—The objects of this company are as follows:—"To acquire work and develop mining properties, and to dispose of them as favourable opportunities offer. To act as agents and contractors for mineowners, and to supply mining machinery. To secure to members the profits derivable from several enterprises by averaging the investments of the company." It was registered 29th ult., with a capital of £300,000 in £10 shares.

Benfleet Brick and Tile.—This company proposes to carry on the business of brick and pipe manufacturers in all its branches. It was registered 30th ult., with a capital of £10,000 in £25 shares. An unregistered agreement of 15th ult. between Alfred E. Stacy and William Smith is to be adopted.

Hare Park Coal.—Incorporated 30th ult. to acquire leasehold or other interest in the coal mines of the Walton Estate, situated near Wakefield, in the West Riding of Yorkshire and the contiguous estates. The capital is £50,000 in £10 shares.

Leonard Boult and Co.—This is the conversion to a company of the business of colliery proprietor, coal and mineral owner, and dealer in coal, ironstone, fireclay, &c., carried on by Mr. George Hare Leonard at Bristol. It was registered 24th ult., with a capital of £75,000 in £25 shares. An agreement regulates the purchase, the total purchase consideration being £40,000 in fully paid-up shares.

London Sulphur.—Upon terms of an agreement of 23rd ult., this company proposes to purchase the undertaking, property, and interest of the Saint George's Sulphur Company, Limited, of 167, St. George's-road, Peckham. It was registered, with a capital of £20,000 in £5 shares, on the 23rd ult. The purchase consideration is £1000 cash and £9000 in fully paid-up shares.

Moorside Fire Clay.—This company was registered 30th ult., with a capital of £15,000 in £10 shares, to purchase and work the Moorside Colliery and Fireclay Works, Moorside, Ainsworth, near Bury.

The Labour Market.—At some of the nut-and-bolt factories at Darlaston, on Friday last week, the operatives resumed work at an advance of 10 per cent. in wages. The majority of the employers have promised to give the advance, and to pay wages in accordance with Mr. Chamberlain's award. A special meeting of the South Staffordshire Conciliation Board was held on Monday, at the Queen's Hotel, Birmingham, under the presidency of the arbitrator, Mr. Joseph Chamberlain, M.P., to consider a demand on the part of the operatives for a further advance of 2s. 6d. per ton for puddling, and 25 per cent. on their wages. Such demand, the representatives of the operatives contended, was fair and justifiable, considering the improved state of trade. Mr. J. P. Hunt, chairman of the employers' section, said the masters were disposed to leave the question with the president. The masters had no proposition to offer, but considered the demand altogether unrersonable. Mr. Chamberlain advocated the adoption of a "sliding scale." The employers agreed with the principle suggested, but contended that the difficulty of agreeing to a standard would make a self-adjusting scale impracticable. The men strongly supported the suggestion, and ultimately both employers and employed resolved to have a separate conference, and bring forward a proposition respecting the application for an advance of wages. Mr. Chamberlain postponed giving his decision for a day or two, but stated that his award would date from the 22nd ult. The first meeting of the newly-formed Board of Arbitration for the wrought-nail trade was held on Monday at Birmingham, Mr. E. Ball presiding. A meeting of masters was held before the opening of the conference, and a list of rules was submitted. It was decided that the Board shall consist of twelve employers and twelve workmen, five of each to form a quorum. The decision of the Board to be binding on the parties to any dispute. In the event of the Board not agreeing the matter was to be referred to the referee, whose decision is final. The rules were afterwards discussed by the employers and workmen. Three meetings of nailers were held on Wednesday at Sedgley and Gornal. At each it was decided that steps be taken in a short time to apply to apply to the Conciliation Board for an advance in wages. It was also decided that committees be formed for the purpose of providing money to pay the expenses incurred by the Conciliation Board. It is thought that in future strikes will be averted and employers and employed arrange matters amicably The owners' side of the South Wales Sliding Scale met on Saturday, at the Royal Hotel, Cardiff, Mr. W. T. Lewis in the chair. At the appointed time four representatives from the house-coal collieries presented themselves, viz., Messrs. J. Blacker, Isaac Evans, J. Jenkins and Thomas Phillips, but only Mr. Abraham attended on behalf of the steam-coal workmen. From what transpired it would appear that the house-coal men fell in with the suggestion made at the meeting held on the 23rd December last, that they should join the steam-coal workmen in forming a board, limiting the number of representatives to four for the bituminous and four for the steam-coal colliers. Mr. Abraham said, when the delegate meeting took place at Aberdare, on the 1st inst., the steam-coal workmen were not prepared to appoint four representatives, but they went so far as to cancel the appointment of the six persons previously agreed upon; and then arranged to hold another meeting on Monday, the 12th inst., for the purpose of obtaining a more comprehensive vote from all the associated steam-coal pits. It is, therefore, expected that all difficulties will be overcome, and a scale will be agreed upon at the adjourned meeting of the joint board to be held at Cardiff on Tuesday, the 13th inst. At a joint meeting of representatives of the colliery owners and miners of the West Yorkshire District, held on Tuesday at Leeds, Mr. H. C. Briggs presiding, consideration was resumed of the proposed sliding scale for wages which has for some time been under discussion. After discussion a sliding scale was finally agreed upon by both parties, which will remain in operation for two years, subject to a six months' notice on either side. In the agreement it is provided that the selling price shall from time to time be ascertained by dividing the net amount realised at the pit's mouth for all coal sold by the total tonnage brought to bank during the same period; and it is also agreed that the average selling price for the 12 months ending December 31st, 1879, shall be taken as the standard price. The Lanarkshire Associated Coalmasters resolved this week to adhere to their former resolution that all blocks must be removed and work resumed before negotiations are reopened. Our Barrow correspondent writes:—Attracted probably by the news of better trade, a large number of skilled and unskilled workmen have found their way to the north-west of England in search of work, but, although there is a far greater amount of employment than for a considerable time past, there is not work for all who come, and many, as a consequence, have to go away disappointed. In the course of three or four months there is every probability of a very brisk demand existing for labour in the north-west of England.—A strike has occurred at the Parkhouse Mines, near Barrow, because Mr. Boulton, the proprietor, declined to make an allowance of payment on account of the wages of the single men. Mr. Boulton during the period of depression kept his mines employed at a disadvantage to himself, and has since given the men an advance of wages. He has, since the strike occurred, found employment for the married men, but has replaced the single men with new hands.

IRON AND COAL TRADES REVIEW.

BARNSLEY AND SOUTH YORKSHIRE.—The coal trade throughout the South Yorkshire district has been extensively carried on during the week, the stoppages during the holidays having provided scope for an additional output. There is a somewhat increased demand for house-coal, but prices are no better, and agents belonging to the district coalowners report that the London trade is dull and higher rates cannot be maintained. The tonnage from the leading Silkstone pits to the metropolis is chiefly in connection with contracts entered into some time ago. There is also a good deal of Barnsley thick coal forwarded, the rates of which are to a great extent fixed, so that the district coalowners are reaping but little advance. The men, however, on the other hand, believe that trade has so far improved that many of them seem anxious to go in for the last reduction they conceded being returned. This is the case at the Thorncliffe Collieries, the owners of which have acknowledged the request by stating that they are willing to entertain the proposal if the men can show that there has been any improvement in the trade sufficient to warrant the five per cent. taken off in September being returned. The same course of action has been mooted at the Wharncliffe, Silkstone, and Barrow Collieries, and similar replies will doubtless be given. The steam-coal trade, notwithstanding the termination of the export season, is pretty good, contracts for the half year having been entered into at an advance of from 4d. to 6d. per ton over last half-year, when prices were the lowest that have been known for several years. Some of the newly opened-out collieries are sending a large tonnage to Barrow, Goole and other places. The demand for small coal and slack is better, there being an improvement with regard to Lancashire and other manufacturing districts. Prices, too, have also improved, but not to a very great extent. There is a very large demand for coke, the output of which commodity is still being increased. In order to further the interest of makers and firms in North Lincolnshire, the Manchester, Sheffield and Lincolnshire Railway Company are running a special train every day from the Wharncliffe Silkstone Colliery to Frodingham with coke. It is stated that, owing to the low price of coal, several firms in the district have to a great extent to rely on the manufacture of coke for what small margin of profit they are making.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—There are on every hand signs of great industrial activity throughout the whole of the Furness and North Lancashire district. The new orders accepted within the past few days have been at full rates, and makers are very firm in their dealings with buyers. The trade doing in hematite pig-iron is, however, comparatively small, so far as new business is concerned, inasmuch as makers are showing a disposition to get clear of a large proportion of the work they have on hand rather than tie themselves down further at present, although the figure to which all qualities of iron have advanced is such as to induce sales where there are any chances of completing deliveries. A large proportion of the output is swallowed up by steel makers, who are very briskly employed, and who have orders which in themselves will almost maintain the activity of their works during the summer months. They are in daily receipt of enquiries as to the price at which they will be prepared to deliver iron and steel in the summer months, but having cleared out stocks, and having sold forward to a very great extent they are not in a position to do do a very considerable new business. Prices remain firm at quotations given last week, 110s. per ton on trucks for makers' works for best qualities of Bessemer iron, 107s. 6d. for all-round qualities, 105s. for No. 3 forge, and 100s. for white and mottled samples. Some makers who are in an especially favourable position are quoting at even higher prices than this; but there is no report of sales at over about 107s. per ton. Iron ores of common qualities have been sold during the week at 22s. 6d. at the mines; but average qualities are at 25s., and best qualities, containing 60 per cent of metallic iron, are selling at 30s. per ton at the pits. Iron shipbuilders are in receipt of new orders, and are employing a large number of workmen. Engineers are busy, and it is expected overtime will soon have to be worked. The coal and coke trades show an improved position, and sales are much larger during the past few weeks, while prices are a little better than of late. Shipping fairly employed on outward shipments of metal.

BIRMINGHAM.—Notwithstanding the anticipatory movement on the part of the marked-bar firms upon the Wolverhampton Exchange day last week, there has been a general disposition to wait the issue of the quarterly meeting this week with a view to obtaining some assured basis as to the probable course of prices and of business in the immediate future. A good deal of anxiety has also been felt as to the pitiable result of the ironworkers' second claim for an advance in wages, which came before the President-arbitrator of the South Staffordshire Wages Board, Mr. J. Chamberlain, M.P., on Monday. On behalf of the men a somewhat startling claim was made—the advance asked for being 2s. 6d. per ton for puddling and 25 per cent. on other wages. The masters urged that, though prepared for an advance, this was altogether an unreasonable demand. The men dwelt strongly on the rapid advances which had been made in the selling prices of iron, and contended that on the present basis of £9 per ton for marked bars they were clearly entitled to the increase they asked; while the employers rejoined that the prices of material had gone up, considerably, so that the quotation of £9 was purely a speculative one. It remained to be seen whether ores could be obtained at that figure, and many houses had large quantities of iron to make at a far lower price. The arbitrator promised to make his award as early as possible, and it was arranged that it should fix a sliding scale of wages up to the 1st of April next. Mr. Chamberlain was not slow to perceive that in the busy times which are evidently approaching in the iron trade of this district some method for adjusting wages questions more convenient than putting the whole machinery of the Wages Board in operation on every occasion was imperatively demanded, and his suggestion for the establishment of a sliding scale, although it met first with some opposition from the employers, on the ground that the system had already been tried in the district and had been found to work unsatisfactorily, was eventually accepted in principle on both sides, and in the course of the next three months men and masters will either have arranged a basis for a sliding scale or the task of fixing it will devolve upon the arbitrator. The further advance of 1s. per ton in iron-making coal announced by Lord Dudley last week, was fully justified by the largely-increased demand which has followed upon the blowing-in of a large number of additional furnaces, and the movement has, of course, tended to strengthen the local iron market. Both as regards pig-iron and manufactured iron a fair amount of orders was kept over from the closing quarter of last year, makers of unmarked iron especially being well under order at prices current a month or two since. New orders can scarcely be said to equal recent expectations, many large consumers having covered immediate requirements during last quarter, and being indisposed to negotiate further transactions at the existing high level of prices until compelled to do so. For certain descriptions of iron the demand from America has heen fairly maintained, and some improvement has also manifested itself in recent advices from India and Australia. The country trade, however, remains inactive. In the aggregate, trade in the local hardware branches has been marked by the quietude which is the usual characteristic just at the turn of the year, when travellers generally are off the road, and little orders from retailers are but few in number and limited in extent. Still, there has been a steady enquiry in most branches, especially from the metropolis and leading manufacturing towns, where it is evident that the general improvement in trade is beginning to exert a favourable influence on the demand for furnishing hardware. Makers of the heavier classes of goods have not yet cleared off orders booked before Christmas. The leading firms engaged in the manufacture of constructive ironwork, such as bridges, girders, gas-meters, &c., have contracts on hand which keep them well employed. Among the foreign orders in this branch of industry in course of execution in the district are a number of railway bridges for British India, and barracks for Batavia and Russia, while the home requirements include gasometers and other gaswork plant for local authorities in the midland district, and bridges for the river Severn. The gun trade is reported as quiet, general orders being insufficient to furnish the local firms with anything like full employment, and the demand for birding guns being very limited, and chiefly confined to the high-class hammerless descriptions. There is a steady trade for iron safes, with indications of an improving demand, and a better tone is manifest in the brassfoundry and chandelier departments, although the leading houses are as yet far from being fully employed. For needles, fish-hooks, buttons, padlocks and other specialities the American demand continues good, and railway material is in fairly active request for India. Some of the South American markets have also been more active recently, but with these exceptions, and the consolatory fact that recent advices from Australia point to improving prospects, the export trade has been rather languid. It is to be hoped that the too-frequently recurring difficulties in the wrought nail trade of the district, on wages questions, will not be so troublesome in future. Last Monday, the masters and the delegates of the men met here, and formally inaugurated a board of arbitration and conciliation for the trade, the rules being fully discussed and partly approved by both parties. Officers were elected, and Mr. Barsano, of Rowley Regis, was selected for the post of referee, provided he will accept the office. A hope was expressed at the meeting that the chainmakers of the district would see their way to avail themselves of the means of conciliation now provided. The same objectionable system prevailed in the chain trade as in the nail trade—the trades were very similar and the workers of the same social position. The subject will probably be further discussed at a future period. There is little doubt, now that the arbitration board is formed, the men will at once give the fourteen days' notice required under the rules for an advance of wages. The colliers of the district are about to ask the colliery proprietors to consent to a variatilon in the existing sliding-scale, which has been in force since December, 1877, and is known as the Birmingham agreement. Under this arrangement, miners are entitled to an advance of 3d. per ton in wages on each rise of 15s. per ton in thick coal, and they now propose that the advance in wages shall be made 4d. per ton for every such increase of 15s. per ton on the price of coal. The concession will be an important one, and it is at present doubtful whether the employers will be disposed to make it. A further step towards a sliding scale was made at Wolverhampton, on Wednesday, at a meeting of the president, vice-president, and secretaries of the Wages Board. Mr. Walker (vice-president) and Mr. Capper (the men's secretary) promised to submit to the employers' section of the Board a draft scheme in the course of the ensuing fortnight. At the same meeting the question of the deduction of the one-fifteenth was raised by the operative section, and it is probable that a circular will be issued by the chairman of the trade making universal the practice adopted already by some firms (in accordance with Mr. Chamberlain's award upon the point) of basing the deduction upon the 7s. per ton for puddling current at the time long-weight became illegal, and then adding all subsequent advances. There is, however, a strong feeling in the trade generally that it would be much more convenient to adopt Imperial weight in all transactions affecting either workpeople or customers. The market on 'Change at Wolverhampton was particularly strong, and a good deal of business might have been done but for the steadiness with which makers declined to book orders at the prices offered, which were scarcely up to the recent advance. The leading galvanising firms held a meeting during the afternoon, and the majority determined at the close of the meeting to advance the prices of galvanised sheets another £1 per ton.

THURSDAY.

Mr. Chamberlain issued his award in the dispute as to ironworkers' wages to-day in the following terms:—"A meeting of the Board shall be called before April 1st, at which each side shall submit a proposition for the sliding scale, and in case they shall fail to agree the terms of such scale shall be submitted to, and decided by me. Wages shall be advanced one shilling per ton for puddling, and ten per cent. on millmen's wages. This advance shall take effect from the 22nd of last December, and shall continue in operation until the 1st of April next, when the new sliding scale will come into force." On 'Change to-day, at the quarterly meeting, there was a very full attendance, and the market was one of the most animated for a long time past. The award of Mr. Chamberlain gave general satisfaction, and, while doubts were expressed as to the practicability of arriving at an equitable basis for sliding scale, strong hopes were entertained that that difficulty would be surmounted and the slidingscale adopted. Marked bars were firm at £9, and unmarked at £8 10s. Best brands Staffordshire pig were nominally quoted hot £4, cold £5, but little could be bought under 5 gs. Hematite scarce and high. Northamptonshire pig 72s. 6d., railroads £8 10s., and sheets (singles) £11. Ore was in good request, and higher in price, the number of buyers from London and Liverpool were large, but in no department were the orders placed very extensive.

CARDIFF.—The rise in ores is a marked feature of the hour. The largest iron makers are secured by contracts made in the early autumn, but those which have come into the market later have been compelled to buy at a great comparative disadvantage, and now the difficulty of the older firms is to get delivery of what they have bought—an advance of nearly 100 per cent. is the latest quotation. It is reported that the Bilboa river is crowded with over 150 craft homeward bound. The bar in that channel is a standing discouragement to the trade, but the urgent representations made to the Spanish authorities have only resulted in an additional impost upon cargoes, levied ostensibly for the purpose of some day removing the bar; but both bar and bar-money accumulate without anything being done, and it is likely the latter will disappear before the former. It is worth the attention of the Associated Chambers of Commerce. In sympathy with the advance in foreign ores British ores have marked some shillings higher, and as there are no stocks anywhere they will rule firmer yet. In coke the advance has been remarkable, certain qualities are quoted at 7s. higher than formerly, and every means of production fails to keep pace with the demand; but as collieries have been multiplying without any addition to the number of coke ovens, the improvement in coke is not shared by the coal from which it is made. As coke is in increasing demand for the large producing blast-furnaces there is likely to be a further advance before long. The steam-coal trade has had a sharp rally by the sudden arrival of some 40 steamers on Monday last. This with sailing tonnage put pressure on the coaling staiths, and at such seasons the cry for further dock accommodation is renewed. Prices for both large and small steam continue bettering, but are slow to follow the great success in iron. The house-coal men have expressed their willingness to sit jointly with the steam-coal men on a sliding scale committee, the solution of the question, however, awaits further meetings to be held next week.

CLEVELAND.—The first quarterly meeting of the year was held on 'Change on Tuesday. There was a numerous attendance from all parts, and 'Change presented a very animated appearance. The price of No. 3 G.M.B. has been stiffening ever since last market day, when 52s. was the average quotation; now 57s. for prompt delivery and 57s. 6d. one month is asked. The returns of the Cleveland Ironmasters' Association have helped to maintain prices, being much more favourable than were anticipated. In spite of an increase in the make of Cleveland iron of 3540 tons, and of other kinds of iron of 10,829 tons, there is a decrease in makers' stocks of 13,662 tons. There is, however, an increase in public stores of 11,179 tons, and in mrkers' stores of 2882 tons. The shipments, foreign, from the port of Middlesborough, as compared with the corresponding month of the previous year, have decreased by 7156 tons, but the shipments coastwise have increased by 17,428 tons. Forge iron is still in request, and maintains its high figure, being only 1s. below No. 3. The finished iron trade is busier than ever, if possible. Prices are 5s. dearer than last week, and great difficulty is found in getting orders placed. Coal, with, perhaps, the exception of household, is feeling the general advance, and coke likewise. There were only two exhibits at the quarterly meeting. The Stockton Nickel Plating Company showed some fine specimens of candelabra rods, keys, irons, &c., plated and burnished brightly. Messrs. Crossley, Ingham and Company, showed highly-finished specimens of fire and glazed bricks and steam guages.

DERBYSHIRE.—The position of affairs in connection with the iron trade of Derbyshire has of late undergone but little alteration. There is no falling off with regard to the business doing in pig-iron, and from what has been seen the new year has set in with a prospect of a permanent improvement in the iron trade. Very few furnaces which are fit for work are now idle, so that the output has of late been materially increased. The foundries where gas and water pipes are cast are doing a fair share of business, and many of the works have special facilities for constructing this class of goods. The district Bessemer steel works are lively, considering the quietness which has prevailed. With few exceptions the collieries are working nearly full time, and now that the holidays have passed there is a good deal of coal raised. Collieries on the Midland line are forwarding a very heavy tonnage by rail to the metropolis, the carriage rate giving them a great advantage over the Yorkshire districts. Steam qualities are, generally speaking, in rather better request, and prices have to some extent improved. An increasing output of coke is being manufactured, and in this branch makers are also demanding an advance. The chief incident of note in connection with mining matters has been the formation of a new association for miners, which is to embrace most of the pits in North Derbyshire, and have its headquarters in Sheffield. Mr. W. Chappell, who for four or five years was agent of the South Yorkshire Miners' Association, is to be the chief official. The district collieries which are likely to form the new federation are Kiverton Park No. 1, West Kiverton, No. 2, Killamarsh, Shireoaks, No. 1 and 2, Eckington five collieries, New Whittington, Clay Cross, Morton, Parkhouse, and other collieries. If the new union is formed there can be no doubt but that many other district pits will join it, as it enables each lodge to hold its own money and pay their proportion to the expenses. The district is just now in a pretty quiet state, disputes being but few, and the men as a rule having a fair amount of work.

FOREST OF DEAN.—The coal trade industry has experienced a reactionary movement since the beginning of the year, and as a result a portion of the train service from the Cinderford Valley has already been relinquished. Merchant aver that this is the penalty of the December advance, and that in the "face" of much lower quotations in South Wales and South Staffordshire nothing short of a severe falling off of orders would arise. This opinion is not altogether shared by the proprietors who require a return of sharp frosts to enable them to render their position tenable. In a changeable climate like ours it is hardly possible to make calculations based on any rule of the elements. A year ago the Forest masters were in a somewhat analogous position having then advanced their quotations after the apparent collapse of the first stretch of winter. Unlike the weather now there was an early renewal of arctic weather. With regard to the 1879 output, the Dean Forest returns have not yet been compiled, but there is some reason for anticipating that it will be in excess of 1878. Taking one source of coal exports, viz., from Lydney, the relative tonnage stands—1878, 201,885; 1879, 255, 753. The December returns are unfavourable, arising primarily in consequence of the severe fogs in the Severn and ice. These statistics do not apply to coals carried per Great Western Railway Company or fuel sent *via* Lydbrook. This week the crude iron trade is quiet, attributable to our near approach of quarterly meetings, when it is expected the Forest pig—hematite—No. 3 will fetch £6 a ton. From the general belief here nothing short of this figure will be accepted. The rapid "rise" in crude iron is a matter of astonishment to all interested in the trade. In 1869 our lowest price reached for No. 3 pig was 71s. 6d., and in 1873 orders were booked in the Forest at £8 5s. In 1875 prices had fallen to 85s., from which period there was a gradual declension until midsummer, since which time Forest pig has advanced from 54s.—to £5 10s.—to £6. In 1873 coke fetched 40s.—best Welsh; Forrest coal 20s. per ton. In 1869 Welsh coke had declined to 13s.; coals, 7s. 6d.—best block into yard; lime-coals, 1s. 6d., the latter class having risen to 9s. into trucks in 1872. Best Forest coals now are 10s. 6d. per ton at the pits. Wages at the Forest furnaces have advanced 5 per cent. from the lowest point, and it is understood there will be an immediate further advance. Best classes of iron ore (hematite) have now reached 15s. per ton. To-day the second mill at Parkend tinplate works was started, giving employment to increased number of hands. The mills were recently purchased from Mr. Crawshay (deceased) by Mr. Charles Morris, of the Vernon Tinplate Works, Britton Ferry, which firm have recently purchased the Old Lodge Ironworks, Llanelly, for conversion into tinplate works. At the Forest mills Mr. Davies is the manager. Trade is generally brisk at the local tinplate mills, a good demand for iron wire still being maintained.

GLASGOW.—The warrant market is in an excited condition, and large transactions are being daily entered into. The chief factor in the rise in the prices is the belief which has got abroad that America will require an enormous quantity of iron in the spring, and as soon as navigation opens, the large stocks here will speedily be transferred to the other side of the Atlantic. At present, there is a moderate amount of iron going across, and the freights by the steamship companies have been advanced about 75 per cent. within a few weeks. It is reported that there is rather a better demand on Continental account, but this buying is probably speculative, in the fear that prices may go further up. On Friday the market was strong, at 67s. to 68s. 6d. cast, and 67s. 4½d. to 68s. 10½d. a month. On Monday a large business was done, from 69s. to 69s. 9d. cash, and 69s. 9d. to 70s. 3d. a month, fluctuating next day between 69s. 6d. and 69s. cash, and 70s. and 69s. 6d. a month. On Wednesday, opening flat on realisation, at 68s. 9d. cash, the price rose to 69s. 9d. eight days, and 70s. 3d. a month. Closing buyers, 68s. 9d. cash, and 69s. 3d. a month; buyers, 1s. ½d. per ton more. Makers have sold largely within the past few days, and have now advanced their prices about 5s. per ton. No. 1 Coltness and No. 1 Summerlee is 82s. 6d., No. 1 Carnbrae, 81s., No. 1 Gartsherrie, Langloan, and Shotts, 80s., No. 1 Eglinton, 74s., No. 1 Clyde, 72s. 6d. per ton. There are now 100 furnaces in blast, against 92 at this time last year. The shipments of pig-iron from Scotland last week were—foreign, 4087 tons, Coastwise, 2950 tons; total, 6677 tons, against 4655 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 6785 tons, against 4000 tons in the corresponding period of last year. About 1000 tons of iron is daily being sent into Connal's store, which is the best outlet open to the G.M.B. makers. Most of the works in the manufactured iron trade have resumed after the holidays, and they are all so full of orders for immediate delivery, that some of them have put up their prices other 10s. per ton. Common bars are now £8 to £9 per ton; ship plates, £8 10s. to £9 10s; boiler plates, £10 10s. to £11 10s.; nail rods, £8 to £8 10s. per ton, a rise from the bottom of fully £3 per ton. There exists a great demand for wrought scrap-iron, and prices have been nearly doubled since August. The exports last week, owing to the holidays, were extremely small, the only item of importance being cast-iron pipes, valued at £2660. The shipbuilders are well employed at present, but as almost no new orders have been booked for a considerable time, the future prospects are again discouraging. Most of the engineers complain of being quiet, though many have sufficient work before them to keep them going for a few months. The coalmasters had a meeting on Wednesday, and agreed to withdraw the reductions recently declared in the colliers' wages, provided they would work the long day. The coal trade is improving in tone, and all would be well if the men could only be got to work steadily.

LANCASHIRE.—In both the iron and coal trades of this district there has been only a limited amount of business doing during the past week owing to the holidays; many of the ironworks and most of the collieries having been closed for four or five days. There was a pretty good attendance at the Manchester weekly meeting on Tuesday, but pending the quarterly meetings there was not much disposition to operate very largely and no very considerable transactions were reported. Prices, however, although little more than nominal exhibited a strong upward tendency, sellers as a rule asking a considerable advance upon last week's rates. For anything like early delivery there is very little iron offering at all, makers as a rule being fully sold over the next three months, and for delivery over the second quarter of this year, although there is a fair amount of enquiry, the prices asked are such as to check any large amount of buying. Lancashire makers of pig-iron have practically withdrawn from the market for the present, but their quotations although only nominal, show a considerable advance upon last week: 67s. 8d. to 68s. per ton, less 2½, being now asked for foundry and forge qualities, delivered into the Manchester district. So far as outside brands are concerned prices have also been little more than nominal. North-country irons have generally been held until after the Middlesborough meeting this week, and for Lincolnshire and Derbyshire irons delivered into the Manchester district as much as 71s. per ton, less 2½ per cent., is being asked. In the finished-iron trades makers are very firm at full rates, £8 10s. per ton being the minimum price for Lancashire bars delivered into the Manchester district, but in the other branches of the iron trade there is still no very material amount of improvement to report. It is only in exceptional cases where machinists or engineers are as yet fully supplied with work, and most of the founders still complain, not only that they are receiving very few new orders, but that they are unable, notwithstanding the enhanced value of the raw material, to obtain any material advance upon late rates. In the coal trade, the stoppage of the pits has enabled colliery proprietors to clear off some of their stocks, but there has been no pressure for supplies, and although in some quarters advanced prices have been asked, generally there are no higher prices ruling in the market. The average quotations at the pit mouth remain about as under:—Best coal, 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s. 6d.; common coal, 5s. to 6s.; burgy, 3s. 9d. to 4s. 3d.; good slack, 2s. 9d. to 3s. 3d.; and common, 2s. to 2s. 6d. per ton. In some exceptional cases, rather more than the above figures is being asked for round coal. In the shipping trade there is a moderate amount of activity, and there is less pushing at the low prices which have lately been ruling in the market. For coke, a good demand is maintained, and makers are able to obtain better prices.

LEEDS AND WEST YORKSHIRE.—The course of events in connection with the West Yorkshire iron trade proceeds as satisfactorily as had been at all anticipated when it became no longer questionable that the revival was a reality. And what is still further in confirmation of certain bright anticipations—a fresh impetus seems to have been given to this important industry since the new year began. Whereas work at the large forges has been about three-quarters time since the trade became reanimated until the end of the year, this week the whole of the working plant has been brought into operation in most instances, and the full number of days worked. Railway orders are beginning to arrive. It is not only that English railway directors and managers are becoming conscious that their rolling stock needs replacing, being deficient in many respects, but the energy with which the Indian Government are prosecuting railway undertakings, is also providing a great addition to the work which our West Yorkshire ironmasters have to undertake. Some of the best specimens of their iron have been sent to London this week, in the shape of axles, for the purpose of being tested comparatively with steel axles. Some novelty is to be introduced into the experiments, and should our West Yorkshire iron pass the ordeal successfully, there will then, no doubt, be a large influx of orders—both home and foreign—into this district, and the superiority of this iron for all extremes of wear and tear will be thoroughly re-established. The manufacture of plates is every day getting more interesting. There is a tendency in the trade to require much larger plates than formerly, and a necessary consequence of this is that the largest rolling mills have the greatest advantages. Deeply sensible of this the Low Moor Company have set up a circle of extraordinary capacity (a description of it being given in the last number of IRON.) Previous to that the largest rolling-mill hereabouts was at Farnley, where an additional furnace is about to be put in blast, and where at present, good orders are being executed for marine-boiler ends, which require plates to be 10 feet 3 inches diameter when rolled, after which they have to be flanged for the boiler-shell and two furnaces. It is in the size of the plates that the West Yorkshire iron has the advantage over steel. The locomotive shops are busier. Orders have been given out for some of the Irish lines, and it is expected that some of the English Companies will be compelled to order as soon as the traffic begins to increase at all. In the other and various mechanical industries of the town and district there is not much now to complain of. The coal trade has no fresh features. It is so much steadier than it was that it gives assurance of four days' work a week to most colliers. Were it not that so much care is taken against accumulating stocks, the miners might have a still better time of it. The coalowners and a delegation of the West Yorkshire Miners' Association met on Tuesday, and arranged for a sliding scale of wages, but for the purpose of allowing time in which a selection of collieries shall be made for the purpose of ascertaining the average upon which the new scale will be based, an adjournment for a fortnight was agreed to.

LONDON.—The metal trade has not slackened one iota in its activity, on the contrary prices are more excited than they have yet been, and buyers seem willing to pay almost anything to get what they want. Of course we cannot expect this sort of thing to last, and it behoves manufacturers not to be too eager to push up values by rejecting orders, otherwise we shall have a sudden reaction, and enterprising speculators will be starting new works for all kinds of manufactures. In iron considerable fluctuations have been manifest and prices well sustained. The Birmingham meeting to-day is contemplated with much interest as likely to settle prices somewhat, which have been fanciful. Copper: steady, Chili bars £66 10s. Tin: firmer, £92 for foreign. Lead: a shade quieter, English £19 10s. Tinplates: this market is very excited and prices have made rapid strides upwards, 30s. is now quoted for cokes, with but few sellers. Quicksilver: £7 5s. per bottle.

NORTH LINCOLNSHIRE.—The first week of the new year contrasts very favourably with that of 1879, so far as the state of the iron and ironstone trade is concerned. The demand for pig-iron is active, and some good orders are on the books for delivery. This has the effect of making the Manchester, Sheffield and Lincolnshire Railway Company busy. The output is larger than for some time past. The Frodingham Iron Company have three out of their four furnaces in blast, and the same may be said with regard to the owners of the North Lincolnshire Iron Company, who have three out of their furnaces in blast. The Lincolnshire Iron Smelting Company keep their large furnaces fully at work, as do also the Redbourne Hill and the Appleby Iron Company, who have two each in blast. The result is that 14 out of the 21 furnaces erected in the district are at work, whilst for fully three-quarters of last year only ten out of that number were blowing. As might be expected, this has given rise to a good deal of action, which will be increased in a short time by the blowing in of two additional ones. The whole of the ore used in the district is obtained on the spot, and the demand, together with that for other districts, has caused a large number of additional hands to be set to work in the ironstone beds. The quantity of ore which is being sent to various parts of Yorkshire, Derbyshire and elsewhere is very large, and seems to be increasing. The Parkgate Iron Company, near Rotherham, the West Yorkshire Iron Company, whose works are at Ardsley, near Leeds, and the owners of the Milton and Elsecar Iron Works are drawing largely from the district, all three firms being in some way or other connected with the district in a direct form. A very large tonnage of coke is being sent over the Manchester, Sheffield and Lincolnshire Company's lines from South Yorkshire, from which district a special train is run every morning with coke alone, and is found to answer admirably. So active has the trade become that many firms in South Yorkshire have greatly increased their output, and it is stated that in several instances the making of coke is the only profitable occupation in connection with some large firms, owing to the low prices of coal and slack. There is also a good tonnage of north of England coke imported into the district, but the extra expense incurred in the carriage is against Durham and other makers.

NORTH STAFFORDSHIRE.—The iron trade of this district, so far as new business is concerned, is, at the time of writing, in a state of suspended animation, pending the Birmingham quarterly meeting. Buyers have been pressing orders on local houses, but the latter have refused to enter into any fresh contracts, except at the prices ruling at the time of delivery, and also to quote until after quarter day, when a further advance is expected to be made. There appears to be abundance of orders waiting to be placed, and when the question of rates has been settled a fresh influx of business is looked for. In the meantime, specifications on account, and contracts already undertaken, are coming in in sufficient numbers to keep all the works fully occupied, and some makers are very much pressed. There is a brisk sale of pig-iron going on, and the output of ironstone is being rapidly disposed of. The coal trade is animated, but in several cases in which heavy contracts were entered into at the old prices, it is being carried on at a positive loss since the rise in wages. The quarterly meeting of the North Staffordshire Iron and Coalmasters' Association was held on the 2nd inst., and was very numerously attended. Trade was uniformly reported to be in a condition of the greatest activity, and the tone of the meeting was of a very cheerful character.

NOTTINGHAMSHIRE.—The coal and iron trades carried on in this county have during the past few years become greatly extended, and it is satisfactory to note that business at the present time is much better than it has been for some time past. In the neighbourhood of Nottingham a majority of the pits are working pretty nearly full time, and prices of coal have of late increased. It is understood that in the district of Hucknall, and at the collieries in the neighbourhood of Erewash Valley, the prices of coal are to be increased, but to what extent is not known; although the pits are working pretty nearly full time it is doubtful whether they can sustain an advance of any material extent seeing that supplies are so plentiful. Some of the larger firms are introducing their coal into the London market, and being a tolerable quality they are sending a pretty good tonnage by rail over both the Midland and Great Northern routes. There is a fair demand for coke for smelting purposes whilst wagon builders, and engineers have of late become much better off for work. The iron trade maintains the improvement noted a short time ago. Most of the available furnaces are kept in full blast, and are turning out an increasing tonnage of this iron which meets a pretty good sale. The foundries are also enjoying a rather better business, but on some branches there is not over much doing.

SHEFFIELD.—Since the commencement of operations for the new year the iron and steel mills have been well employed, and there are evidences of increasing trade. The iron market is fairly brisk, and the rates are stiff, but we are unable to chronicle any advance. Best makes of boiler plates are selling freely, and there is a large demand. It is evident that this trade will improve. The overhauling of plant during the Christmas vacation is sure to lead to more work, and boiler-makers and machinists will become busy. Plates, both ship and boiler, are selling freely at the rates given immediately before Christmas; but first-class boiler plates have advanced to £14. A noticeable feature is the first-class makes are selling the best, and in these goods much business will be done in the course of the month. Manufacturers are, however, averse to accepting contracts at the current prices of the day, and will not commit themselves forward. Scotch houses are remitting favours for ship plates heavily, and there are evidences of improvement in this direction. There has been a slight advance in the price of hematite steel since the Christmas vacation. Best marked ingots which realised £8 15s. at the end of the year are charged £9; but it is not thought that at present there will be any further increase. Common Bessemers are improving in value, but as there is a full supply of hematite ore for the present the alterations are not of much consequence. In the steel department there has been some complaints of manufacturers taking orders for railway material at a loss on the cost of production when the rates of the day for raw material are considered. Large stocks of pig-iron have, however, been accumulated, and these are gradually being worked off. When these stocks of raw material have been worked off, an advance all round in the price of Bessemer material is expected—still not a heavy one. Indications are that trade will be steady. There is no doubt that at present the means of supply are above the requirements, and any advance in rates will be a slow one. The cutlery trades are not really brisk, but there is a heavy improvement to note on foreign account. London shippers are consigning largely to South Africa; the Levante trade is fairly brisk, and there is an improving demand for South Australia and Havana—South Sea Islands market. All these points are in favour of a resumption of the Colonial markets accepting Sheffield goods; though for a year or two past it has been broadly stated that the Americans had got the lead in these dependencies. In axes and files, however, the Americans are still doing a good trade in our Australian possessions. The coal market is excessively quiet, and sales are not up to the usual average of this time of the year. The colliers of South Yorkshire appear to have divided amongst themselves, as a new association of them has been commenced in this district. With two rival unions the consequences to the men may be disastrous. Prospects at present point to a forthcoming steady trade in Sheffield goods, but no undue inflation. Prices: boiler-plates, £12 15s. to £14; ship-plates, £11 15s. to £13; Bessemer ingots, best marked £9, seconds, £7 10s. Cast steels: best special makes for engineers, £45; seconds, £35 and upwards; tool steel, £38; seconds, £27 and upwards; spring steel, £15 (rise of £1); steel for wire, £16; Bessemer ditto, £14 10s.; a heavy demand for the latter. Common cast, from £8 10s. upwards (rise of 10s.) Coal, best branch, 13s. 6d. on wharf; Silkstones, 9s. (at pit) seconds, 7s. 10d; nuts, 6s. 6d., slack, 4s.

SOUTH STAFFORDSHIRE.—The new orders for hardware that have been placed this week are not large, taking the industries all round. This is usually the case when, as now, the quarterly meetings are being held, and does not therefore excite any fear. Steady employment is being found at most of the factories. The advanced prices of iron are sure to lead, when this week is over, to the issuing of more circulars by hardware producers quoting up their goods. At present, the chief industry which has taken this course is the wrought-iron tube-makers, who have reduced discounts a further 5 per cent. The galvanisers are very strong in price in all their departments, but more especially touching sheets. As to this commodity, so anxious are buyers to secure supplies that even what makers consider as "prohibitive" quotations fail to keep them off. The cabinet lock makers are complaining much of the German and French competition, especially in the London market. Ships' locks are in better demand from the Tyne and the Clyde, and from our Government dockyards. Light chains are dull, and neither cut nor wrought nails are busy. The quarterly meeting of the iron and coal masters, held in Wolverhampton on Wednesday, was an influential gathering. The new prices for all descriptions of finished iron were firmly maintained, and even at these advanced rates manufacturers were not, as a rule, anxious to look for delivery far ahead. The galvanised iron makers had a special meeting, and determined not to take further orders until after Saturday next, on which day they decided that their prices should be raised £1 per ton. This will make 24 w.g. £21 in London, packed in felt, and all other sizes in proportion. The Lilleshall Iron Company announced that the prices of this pig-iron were now based upon £4 for hot and £5 for cold blast. Upon the nominal prices of this firm a quarter ago these figures are a reduction of 15s. The agents of pig-producing firms outside this district, however, were not influenced by this decision, maintaining the prices they sought last week.

WEST CUMBERLAND.—There is a very brisk demand for hematite iron of all qualities, and as the producing power of the district is not yet all in full work, efforts are being specially directed to put all the furnaces in blast which at present are standing idle. With the exception of one or two, the whole of the furnaces in the district will be in blast by the close of this month. The business transacted during the past few days shows a very healthy tone in the market. Makers are fully employed and have large deliveries to make, and buyers are pressing in many instances orders for forward delivery at present prices thus showing that they are confident in a continuance if not apprehensive of an improvement in the present value. The production of Bessemer iron has to be very large in order to meet the requirements of steel makers in the locality, and of steel makers in Yorkshire and elsewhere, but there is also a good demand for Bessemer, as well as forge and other descriptions of iron both on home and foreign account. Indeed within the past few months large sales have been made for delivery to America, and although this is the middle of the winter season many heavy cargoes of pig-iron are being sent to America. Iron ore has also been shipped in large quantities, and considerable specifications of iron ore have yet to be completed. So far as present appearances are concerned it seems probable that for some time to come at least there will be a large consumption of native hematite of American manufacture. Iron ore is beginning to be a very scarce article, not that the supply is showing any indication of being exhausted, but because sales have been so largely made that raisers are not at present in a position to enter into many new contracts. Prices are maintaining the quotations given last week, sales having been made from 22s. 6d. to 30s. at the mines according to quality. A very large trade is being done in finished iron and the mills are briskly employed. Prices have gone up several shillings per ton, and makers find a difficulty in supplying the demands of the market. The coal trade is more briskly employed than ever, and the coke-burning industry is making progress.

CONTINENTAL MINING AND METALLLURGY.

IN the review of Continental trade for 1879 which we gave in our last issue, we adverted to the fact that the present revival in the iron trade was not solely due to American buying, and we left it to be inferred that the European revival might have taken place had America stayed out of the markets of the Old World. On the signing of the Treaty of Berlin, strong hopes were formed of an immediate revival of trade. These hopes were not realised, but it does not follow that the influences of the pacification ratified at Berlin have been nullified. The demission of Marshal MacMahon—a fact now forgotten in the swift changes of the political phantasmagoria of France—tended greatly to facilitate the resumption of commonplace business by the nation at large, and the extinction of the Napoleonic dynasty has told on the demand for pigs, bars and angles. An end was put to the unsettledness of German trade by the May vote of the Reichstag, when, in the teeth of all expectation, Bismarck, abandoning his former principles, crossed over to the Protectionist platform, and, with startling rapidity, carried through measures for the immediate taxation of imported iron. The depression had stimulated Belgium to the search for new markets and new uses for iron, and to the cheapening of means of production, and her *clientèle* had become so extended that she would immediately be sensible of any improvement in general business. The State, too, actuated alike by motives of prudence and philanthropy, gave out a considerable total of work, jealously reserved to Belgian manufacturers, and valuable as forming a backbone of business. Meanwhile the depletion of capital which had occurred in connection with unsound speculations, both European and extra-European, had been stopped, and a reserve was being gradually formed available for genuine business. The readjustment of the machinery of supply and demand has thus really been carried out by many causes, and the Vanderbilt order for rails seems only to have acted as the "striker" which set that machinery in motion. Enterprise will again lift its head, and though it will probably be more circumspect, it is not likely to be less resolute than in past years, and we think it not illogical to conclude that the world has entered on a fresh cycle of industrial and commercial prosperity.

FRANCE.—The December *Bulletin* of the French Forgemasters' Association publishes the following returns for French metallurgical imports and exports for the eleven months January to November, 1879, compared with the corresponding period of 1878:—Imports—Pig, 142,267 tons (151,708 tons); iron, 65,793 tons (64,264 tons); steel, 6252 tons (5651 tons). Exports—All classes of make, 151,155 tons (151,380 tons). The total imports, 214,312 tons, are below those of 1878 by 7310 tons, the decline being at the rate of 3 per cent. This decline is in pig alone, a slight rise being noticeable in iron and steel. The exports show an insignificant falling off of 0·1 per cent. The exports on importation warrants have declined by some 5000 tons. The ores imported were 875,515 tons and 830,003 tons respectively; and the exports were 62,417 and 68,595 tons. The increase in the imports of ores is at the rate of 5 per cent. The official declarations made by the *Bulletin* of the state of business at Paris, is to the effect that there has been no change of rates since the publication of the November *Bulletin* (these publications are made at the end of the month) but that a rise was announced for January 1st, 1880. "The complete cessation of business, owing to the stoppage of traffic by road in Paris and in the railway stations, is one of the causes which have hindered this rise from taking effect sooner."

The Association recapitulates the statistics of importation and exportation published by the French Customs and those published by itself concerning the make of France, for the purpose of approximating to the home consumption in the years 1878 and 1877. Thus:—

	1878. Tons.		1877. Tons.	
Pig-irons:				
Made in France	1,508,246		1,522,266	
Imported......	184,863		203,528	
		1,693,109		1,715,794
Exported......	..	45,899		49,784
Remained in France (for consumption or stock)	..	1,647,210		1,676,010
Irons and Plates:				
Made in France	805,340		872,798	
Imported......	91,484		83,011	
		896,824		955,809
Exported......	..	103,654		111,845
Remained in France......	..	793,170		843,964
Steels:				
Made in France	289,327		241,948	
Imported......	13,254		7491	
		302,581		249,439
Exported......	..	29,086		17,849
Remained in France......	..	273,495		231,580

A table is also given of exports and imports showing the countries concerned in business with France, and the extent of their relations. The business detailed, however, is restricted to that on duty-paying goods, and excludes all information as to that done in goods handled by means of importation warrants (acquits-à-caution). The latter form about two-fifths of the total trade of France with foreign countries. In 1878, the proportions of duty-paying imports were, in round figures, 84,000 tons from England, 31,000 tons from Belgium, 20,000 tons from Sweden, and 15,000 tons from Germany. The exports were, 27,000 tons to Belgium, 6000 tons to America, 5000 tons to Germany, 3000 tons to Algiers, 1000 tons each to Spain and Switzerland; and under 1000 tons each to Italy and Russia. Exports to the United States have, of course, risen during 1879, but larger exports would not have been unwelcome, if we take the right sense of the following paragraph at p. 391 of the *Bulletin*:—"So far, the Americans have confined themselves to taking away, as return freights for their grain ships, ores of high quality brought in the first case from Algeria. The agricultural produce they have brought chokes our market, while the ore they take away makes scarcer the stocks in hand, and our ironmasters are threatened with a rise in prices of their most necessary raw material."

It is gratifying to see a Paris contemporary pointing out that if France is suffering from cold as in the winter of 1788-89, and from a bad harvest of both corn and wine, yet that corn is not rising, as it did in the winter of the Revolution, from 12 fr. to 36 fr. the hectolitre.

Rates are progressing in France without stopping to take breath. It is not surprising to find prices rising at Paris for immediate supplies, as there is great difficulty, owing to the blocking of the railways, in getting them renewed. But it is not so easy to see why the Nord should be carrying rates for merchant irons up to 190 fr. and 200 fr., and why prices in Champagne should be treading on the heels of those in the Nord, nor why forge pig should be over £3 in Meurthe-et-Moselle, while foundry pig, if it can be had at all, fetches £4. But the demand is out of all proportion to the means of satisfying it, and the wild flights of prices which occurred in 1872-3 may not impossibly take place again. Late buyers are still crowding the markets, and to satisfy immediate demands large contracts are given, on condition that partial delivery take place at a short date. Even the centre and the south are now participating in the movement which originated in the north, and spread next to the east. Large buyers, accustomed to the deference of markets, are treated as inexorably as smaller ones. Specifications recently issued by the State for rails and by the City of Paris for piping were withdrawn in consequence of the high range of the rates tendered, which forced the respective schemes to be revised. The maximum price allowed by the specification was 250 fr.—say £10—the lowest tenders received were on the basis of 260 fr. per ton delivered, say 230 fr. at the works. Why cut prices fine, it is very fairly urged, when every mill in France is "full" for all 1880? At the end of November, the State contracted for 12,000 tons of rails, to be delivered at Gray. The rails were shared in equal proportions between Terrenoire, Firminy, Forges de la Marine, and Creusot, and the rates were, in the order of the works, 233 fr. 95, 234 fr. 50, 234 fr. 75, and 235 fr. We will tabulate, for the sake of recording, a few of the prices with which trade opened in France in 1880:—

	fr.		fr.
Forge pig (Meurthe-et-Moselle)	80	to	—
Foundry pig No. 3 ,, ...	95	,,	100
Merchant irons (Nord)	190	,,	200
Beams .. ,, ...	200	,,	210
Plates .. ,, ...	220	,,	—
Steel rails (Centre)	230	,,	—

These quotations do not include the cost of delivery—*i.e.*, they are the prices "on rails."

Several mills and furnaces in the North and East have been obliged to stop, through the supply of fuel having been cut off, either by the Belgian strike or by the railways being choked. The roads being bad, goods are left waiting in trucks which are wanted for further service.

To the taste for statistics which is growing up in France, is due the foundation of the "Annuaire Statistique" by the Ministry of Commerce. This useful publication tells us that, of the 37,000,000 inhabitants of France, there are 18,000,000 living by agriculture, and 9,000,000 by manufactures. M. Danelle-Bernardin, in the report on the metallurgy of France he has just presented to the Tariff Commission states that metallurgical industry is carried on in 61 departments of France, in 428 works, employing 1490 steam-engines and 829 hydraulic motors, and occupying 120,000 hands. The ironstone raised averages 3,500,000 tons per annum, and the pig made, 1,400,000 tons. The annual make of iron is estimated by M. Danelle-Bernardin at 650,000 tons, and of steel rails at 281,000 tons. These figures rather confirm than contradict those quoted by us last week. The annual value of metallurgical business done in France is estimated at £17,000,000. The men engaged in the iron trade are reckoned amongst the best paid and most fortunate of French artisans.

Free lectures on points of practical science connected with steam and the steam-engine are being delivered before the Paris Stokers' and Drivers' Society (*chambre syndicale*) by MM. Bougarel and Testud de Beauregard. The lectures are numerously attended and enthusiastically applauded.

The shorthand reports taken of the congresses held and lectures delivered during the time, and in connection with the Paris Exhibition, are now being published by the Imprimerie nationale, rue Vieille-du-Temple, 87, at Paris. There are seventeen volumes already on sale.

On leaving the Ministry of Public Works, M. de Freycinet recapitulated the measures to which the ministry stood engaged, and reported on the present state of the new public works inaugurated in January, 1878. Setting on one side the sums required for the buying-out of railway companies, a sum of £180,000,000 stands devoted to railway construction and improvement, the time over which the new works will be spread being twelve years from January, 1878, and the length of new line to be constructed being estimated at over ten thousand miles (18,000 kilometres). As almost three years are consumed in formalities between the drawing up of the first plans and the commencement of excavations, much has not yet been done in the building of new lines. But the middle of 1880 will see a serious beginning made, and by the opening days of 1881 there is reason to hope the works will be in full progress. Already more than a thousand extra engineers have been attached to the service of the Ministry, and this number is increasing. In 1877 there was spent on the State railways, £1,000,000 sterling. In 1878 over £2,000,000 was spent on them, in 1879 over £5,000,000, and in 1880 some £8,000,000 will be absorbed by them. French ironmasters may well be careless about competing with the Belgians in the ports of China or South America. M. de Freycinet states further, that all his scheme is so perfectly geared together (*engreue*) that it need simply have the necessary power supplied to it to keep moving automatically forward. The concluding paragraph of the ex-Minister's letter is worth attention:—"It is by the establishment of international communication that civilisation is diffused and confirmed. Africa, on the southern threshold of France, claims our early attention. We have to make an effort for the acquisition of the immense tracts of country which are watered by the Niger and the Congo. At the moment at which I am writing three missions of exploration are starting from the centre, the east and the west of Algeria, for the purpose of finding out whether it is not possible to bridge the Sahara with a line of rails which shall connect Algeria with the Soudan."

The cold weather and the blocking of the streets at Paris have brought about a great scarcity of fuel, and merchants have been making so splendid a profit of the public misfortune that a great scandal has been the result. Coal has been sold in Paris at 120 fr., say £4 19s. the ton, and a string of 300 to 400 persons wait every morning at the Courcelles Works, where the Paris Gas Company retails its coke, to take their turn in getting a supply. About 80 people are served in an hour. The prices, fortunately, were fixed in the autumn. The price of coal has come up for discussion in the proceedings of the Paris Municipal Council. The Paris and Lyons Railway has threatened to close its doors until street traffic can be resumed and the goods it brings up be cleared out from its goods sheds. In the Nord and Pas de Calais, and also in the Loire and Centre, coalowners are making gifts in kind to the poor, and their example is followed in many cases by manufacturers. M. Henri Schneider has sent 1000 hectolitres of coal to the poor of Autun.

M. Léon Krafft recommends in the *Journal des Mines* the utilisation of the "burning fountain," which, since the time of Julius Cæsar, so it is said, and before then, has been kindled at Saint-Barthélemy, near Grenoble (Isère). The gas, the combustion of which has gone on with so much perseverance, is ordinary marsh-gas. It is proposed to distil boghead in the neighbourhood of the spring, and mix the distilled with the natural gas for consumption in the usual way. Borings are proposed to find petroleum in the neighbourhood of the "fountain."

BELGIUM.—The Ministry of Finances publishes the following account of imports and exports for the period January to November, 1879, inclusive, the account for the corresponding period of 1878 and 1877 being juxtaposed:

IMPORTS (ELEVEN MONTHS).

	1879. tons.	1878. tons.	1877. tons.
Steel	3836	4537	4110
Pig and scrap	155,302	152,025	162,551
Wire	1906	3349	3674
Rails (iron)..........	883	51	447
Plates	172	148	278
Section irons	4484	4055	4000
Anchors, &c.	187	117	116
Nails	348	360	390
Unclassed goods......	2549	2662	2274
Castings	1251	1922	1340

Exports (Eleven Months).

	1879. tons.	1878. tons.	1877. tons.
Steel	35,051	17,803	11,326
Pig and scrap	27,907	4376	11,165
Wire	3045	2619	1827
Rails (iron)	27,158	29,171	36,871
Plates	21,752	21,387	15,303
Section irons	143,218	111,562	99,989
Anchors, &c.	7	—	—
Nails	7643	8052	8615
Unclassed goods	20,008	14,430	12,687
Castings	9860	5298	1860

Belgian mills and furnaces have been sadly embarrassed by the weather, which has hindered the carriage of fuel by rail or canal, has stopped waterwheels, has cooled steam-pipes, and interfered in many other ways with business. As for the Borniage strike it is over for the present: perhaps the spring may witness a revival of it. Prices are still firm, and they show no disposition to recede. At Charleroi 200 fr. is quoted as the standard price for January, blooms bringing 160 fr., and forge pig 95 fr. (£3 10s.) Export orders are abundant, and the successive advances which are taking place in prices do not check their inflow. The additions made at present to the productive capacity of Belgium are insufficient to meet demands, which show no symptoms of slackening. Cockerill has given an order to its agents not to engage in any transaction of the nature of a long-term engagement. Contracts for steel tires recently let were on the basis of 239 fr.; a month ago they were taken at 197 fr. There are a good many enquiries in the market for iron rails. A few hundred tons of angles have been sold in Belgium by a French firm, to the mutual surprise of the two parties. There is a strong rise in coal, coke and ores.

NEW PATENTS.

All the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 5313 to No. 41, being the entries from Dec. 30th, 1879, to January 5, 1880.

NEW APPLICATIONS.

Annealing Plate Glass.—*W. W. Pilkington, St. Helen's, Lancaster.* [26

Apparatus for Filling Seed Sacks.—*B. Tideman, Crossness, Kent.* [2

Axles.—A communication.—*A. M. Clark, London.* [5318

Basic Firebricks.—A communication.—*I. Furstenhagen, Bradford.* [10

Bottle Stoppers.—*F. N. Mackay, Liverpool, and A. E. Weston, London.* [5313

Boot-Making Machinery.—*E. Vanse and J. Armitage, Leeds.* [5317

Break-Down Guns.—*F. Beesley, London.* [31

Bridges.—*J. Britten, London.* [14

Buttons.—A communication.—*W. H. Chase, London.* [22

Card Clothing.—*E. J. J. Lecœur, and J. M. Hetherington, Manchester.* [12

Chronometers, &c.—A communication.—*E. A. Brydges, Berlin.* [5328

Cigarrette Machines.—*J. C. Lejeune and A. E. Deceufle, Bagnolet, France.* [5314

Cot for Children.—*J. H. Wilson, London.* [4

Cutting Glass Vessels.—A communication.—*W. R. Lake, London.* [5325

Digging Machinery.—A communication.—*F. Wirth, Fankfort-on-the-Main.* [5333

Drawing Roller Apparatus.—A communication.—*W. R. Lake, London.* [5342

Dressing and Rolling Stone.—*M. R. Western, and F. R. Clarke, London.* [29

Electric Lamps.—*J. W. Swan, Newcastle-on-Tyne.* [18

Electric Lighting.—*T. A. Edison, Menlo Park, U.S.A.* [33

Filter Press.—A communication.—*W. E. Gedge, London.* [24

Filter Presses.—*S. H. Johnson, Stratford.* [38

Fire Alarm and Extinguisher.—A communication.—*W. Simpson, London.* [3

Four-Wheel Carriages.—*J. G. Harrison, Birmingham.* [8

Gas Apparatus.—*H. C. Bull, London.* [5323

Gas Furnaces.—*T. Williamson, Glasgow.* [37

Governors.—*G. F. Pottle Boston, U.S.A.* [9

Heads for Carriages.—*C. Thorn, Norwich.* [41

Iron and Steel Manufacture.—*H. C. Bull, London.* [5324

Iron Doors, &c.—A communication.—*A. Longsdon, London.* [32

Iron Making.—A communication.—*B. Hunt, London.* [5330

Lawn Tennis.—*G. C. Bussey, London.* [34

Magnesian Fire Bricks.—A communication.—*T. Morgan, London.* [21

Magnetic Curative Appliances.—*F. Baply, Leeds.* [5

Meat-Cutting Machinery.—A communication.—*W. R. Lake, London* [5321

Moulds for Bottles.—*W. Arthur, Dublin.* [6

Musical Instruments.—A communication.—*E. Hunt, Glasgow.* [5334

Ordnance and other Firearms.—*W. Palliser, London.* [23

Ores.—*J. F. N. Mackay, London.* [5336

Optical Illusions.—*T. H. S. Hawker, London.* [15

Paper Manufacture.—A communication.—*J. Wetter, London.* [28

Paving Setts.—*J. Lindsay, Edinburgh.* [27

Pianofortes.—*J. Turvey, Southport.* [5315

Piano Rest Piece.—*J. Pooley, London.* [25

Polishing Table Forks.—*E. Hutchison, London.* [7

Process for Treating Ores.—A communication.—*P. M. Justice, London.* [16

Registering Hire of Vehicles.—A communication.—*J. Imry, London* [5334

Rhea Fibre.—A communication.—*T. Lawson, Leeds.* [5318

Rolling-Mills.—A communication.—*R. J. B. Mills, London.* [30

Safety Lamps.—*W. Tate, Blackwell, Derbyshire.* [49

Screw Propellers.—*S. W. Snowden, Dublin.* [5322

Screw Propellers.—*J. Newall, and G. W. Newall, London.* [5320

Ships' Sleeping Berths.—A communication.—*W. R. Lake, London.* [13

Slag Transporting Machinery.—*C. J. Appleby, London* [35

Steam and Water Jet Motors.—A communication.—*P. Jensen, London.* [17

Steam Boilers.—A communication.—*W. R. Lake, London.* [20

Steering Apparatus.—*M. Nordmann, Dresden, Saxony.* [19

Stop Valves.—A communication.—*J. G. Wilson, Manchester.* [5326

Switches for Telephones.—A communication.—*A. M. Clark, London.* [5337

Telegraphic Apparatus.—A communication.—*E. de Pass, London.* [5319

Telephones.—A communication.—*A. White, London.* [5335

Tenoning Machine.—*S. Skinner, Eastbourne.* [11

Umbrellas.—*A. Macmillan, London.* [1

Utilising Heat in Waste, &c.—A communication.—*C. D. Abel, London.* [36

Washing Apparatus.—A communication.—*C. Griffiths, London.* [39

Washing and Dyeing Machinery.—*G. Barnley, Keighley, York.* [5320

Waterproofing.—A communication.—*F. G. de Buda, London.* [5310

Yarn Machinery.—*T. E. Ainley, Longwood, and W. Cliffe, Golcar, near Huddersfield.* [5327

COMMERCIAL.

DIARY OF FORTHCOMING SALES.

Notices of Sales of Engines, Plant, and Machinery, Implements, Mines, and Collieries.

For particulars of entries see Advertisements at end of paper.

Places of Sale.	Property for Sale.
Wear Ironworks.	Ironworks.
Glasgow.	Dennystown Forge Works.
Middlesborough.	Thrislington Colliery.
Glamorganshire.	Ironworks.
Middlesborough.	Ironworks and Mines.
Gainsborough.	Secondhand Portable Engines.
Whitehaven.	Locomotive Tank Engines.

OPEN CONTRACTS.

Trinity House Corporation.	Wrought Iron Oil Drums.
Trinity House Corporation.	Gun Metal Fittings.
Cheshire Lines Committee.	Permanent Way Materials.
G. N. R. Co.	Old Railway Stores.
War Office.	Iron Cuttings.
India Office.	Pumping Engines, Boilers, &c.

PARTNERSHIPS DISSOLVED.

Paul and Acworth, Fenchurch Street, City, and Victoria Street, Westminster, analytical chemists.—Holt and Co., Liverpool, metal factors.—Russell Street Saw Mills Company, Keighley, wood turners.—W. Rathbone and Co., Burslem, earthenware manufacturers; as far as regards G. Hadfield and J. Booth.—A. Dashwood and Co., Farnham, and Mark Lane, City, horticultural engineers; as far as regards A. Dashwood and J. Whitehead.—Stephens and Bastow, Bristol, contractors.—J. and H. Watts, Send, near Woking, proprietors of thrashing machines.—J. H. Morris and C. F. Dewar, St. Paul's Churchyard, City, umbrella-manufacturers.—Williams and Cashmore, Birmingham, brass-founders.—Beddow and Sturney, Willenhall, Staffordshire, lock manufacturers.—Ratcliffe and Sons, Hawarden, Flintshire, engineers.—S. P. Austin and Hunter, Sunderland, iron shipbuilders.—T. H. Ward and Co., Birmingham and Smethwick, engineers.—Ricketts and Cox, Pocock Street, Blackfriars, electro-platers.—H. H. Hicks and Co., Southwark Street, wholesale ironmongers.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

(Metal Market, City, Thursday Afternoon, 4 P.M., (*January* 8, 1880.)

METALS AND ORES.

	January 1.		January 8.	
	£ s.	£ s.	£ s.	£ s.
Ores—per ton				
Red hæmatite, British (p tn)	0 15/	1 2/6	0 15/	1 2/6
Do., do., Spanish	0 17/	1 6/	0 17/	1 6/
Clay ironstone	0 17/	0 19/	0 17/	0 1/9
Oolitic	0 7/	0 10/6	0 7/	0 10/6
Manganese ores, 70%	4 0/	—	4 0/	—
Burnt iron 60% ores unit	0 0/1½	—	0 0/1½	—
Copper (per ton)—				
Chili, for 90 per cent.	65 10/	66 0/	66 10/	—
Wallaroo	75 10/	76 0/	75 10/	76 0/
Burra Burra	74 10/	—	74 10/	—
English Tough	70 10/	71 0/	71 0/	72 0/
English Ingot, best	72 0/	73 0/	72 10/	73 10/
Sheets sheathing and rod	76 0/	77 0/	76 0/	77 0/
Bottoms	80 0/	81 0/	80 0/	81 0/
Ore per unit	13 0/	13 0/4	13 0/	13 0/4
Phosphor Bronze				
Special Bearing Metal (p tn)	110 0/	—	110 0/	—
Other alloys (per ton	115 0/	130 0/	115 0/	130 0/
Tin (per ton)—				
Straits (Cash)	91 10/	92 0/	92 0/	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banca	—	—	—	—
English Ingots	95 0/	95 10/	95 0/	96 0/
Do. Bars	96 0/	96 10/	77 0/	—
Do. Refined	98 0/	—	98 0/	—
Australian	91 10/	92 0/	92 0/	—
Tin *Plates, per box, I.C. coke f.o.b. London	0 26/	0 28/	0 30/	0 32/
IX. do.	0 31/	0 36/	0 35/	0 40/
I.C. charcoal	0 25/	0 33/	0 34/	0 36/
I.X ,,	0 35/	0 39/	0 40/	0 44/
Lead (per ton)—				
Soft English pig	16 0/	19 10/	19 10/	—
Do. W.B.	—	—	—	—
Spanish soft	19 0/	—	19 7/6	—
Do. with silver	—	—	—	—
Sheet milled	20 0/	—	20 0/	—
Red lead	20 10/	—	20 10/	—
White	24 0/	—	24 0/	—
Patent shot	22 0/	23 0/	22 0/	23 0/
Zinc (per ton)—from No. 9 Gauge.				
Sheets, rolled	24 0/	—	24 0/	—
Do., foreign	24 5/	—	24 5/	—
Spelter (per ton)—				
Silesian, com	19 10/	—	20 10/	—
Rhenish	—	—	—	—
English	—	—	—	—
Quicksilver, bot.	7 0/	—	7 5/	—
Antimony ore (per ton)—				
Australian	11 10/	14 10/	11 10/	14 10/
Spanish	—	—	—	—
French Star	65 0/	—	66 0/	68 0/
Regulus—				
Crude (per cwt.)	1 14/	—	1 14/	—
Nickel (per lb.)	0 4/3	0 4/6	0 4/3	0 4/
Brass (per lb.)—				
Sheets, 48 × 24.	0 0/6½	—	0 0/6½	—
Tubes	0 0/8½	0 0/9½	0 0/8½	0 0/9¾
Wire	0 0/7¾	—	0 0/7¾	—
Yellow metal	—	—	—	—
Asbestos (per lb.)	0 0/3	0 1/	0 0/3	0 1/
Plumbago (per ton)—				
Ceylon lump	13 6/	—	13 5/	—
Do. chip	10 0/	—	10 0/	—
Do. dust	8 6/	—	8 6/	—
Coals (per ton)—				
East Hartlepool	1 2/	—	1 2/	—
Lambton	1 4/	—	1 4/	—
Tees	1 4/	—	1 4/	—
Hartley	1 2/	—	1 2/	—
Hetton	1 4/	—	1 4/	—
Hawthorn	1 3/	—	1 3/	—
Tunstall	1 2/	—	1 2/	—

IRON.

	January 1.		January 8.	
Iron, per ton (at works)*—	£ s.	£ s.	£ s.	£ s.
Bars, Welsh, common	6 5/	6 7/	6 5/	6 7/
Do. Best	7 0/	—	7 0/	—
Scotch, Common	7 10/	—	8 10/	—
Do. Best	8 0/	8 10/	9 0/	—
South Stafford, common	7 5/	8 0/	8 0/	—
Do. Best	7 15/	8 10/	8 10/	—
Sheets, singles, Cleveland	8 0/	9 0/	9 0/	—
Staffordshire	8 5/	10 0/	9 5/	9 10/
Do. doubles, Staffordshire	9 15/	11 10/	10 15/	11 5/
Scotch	10 5/	—	10 5/	—
Do. Lattens, Staffordshire	11 15/	—	12 5/	12 15/
Plates, Ship, Stafford.	8 10/	9 0/	10 0/	10 5/
Do. Scotch	8 5/	8 15/	8 5/	8 15/
Do. do. Stafford	11 0/	—	12 0/	12 10/
Do. Boiler, Stafford.	9 0/	10 0/	9 0/	10 0/
Hoops, Stafford	7 10/	8 10/	8 10/	9 0/
Nail Rods, Stafford	7 17/6	9 0/	7 17/6	9 0/
Swedish in Lond	10 10/	—	11 0/	11 10/
Angle Iron, Welsh	7 10/	9 0/	7 10/	9 0/
Do. Stafford	8 10/	9 10/	8 10/	9 10/
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 0/	6 10/	6 0/	6 10/
Do. Scotch	—	—	—	—
Rails, Welsh	5 0/	5 10/	5 0/	5 10/
Do. Stafford	8 0/	9 10/	8 0/	9 10/
North England	5 5/	—	5 5/	—
Light Rails, Welsh	5 7/6	5 15/	5 7/6	5 15/
Do. Stafford	7 10/	8 0/	8 0/	9 10/
Pig Iron at Glasgow				
Scotch warrants	3 7/	—	3 8/9	3 9/9
Do. No. 1	3 7/6	3 15/	3 11/	4 1/
Cleveland, Tyne or Tees	2 1/	2 6/	2 1/	2 6/
Indian Charcoal. London	—	—	—	—
Wrought Iron Girders	13 0/	18 0/	13 0/	18 0/
Bolts and Nuts	13 0/	15 0/	13 0/	15 0/
Fish Bolts	13 0/	20 0/	13 0/	20 0/
Washers	13 10/	14 0/	13 10/	14 0/
Rivets	10 0/	13 0/	10 0/	13 0/
Spikes	12 10/	14 10/	12 10/	14 10/
Swedish Iron— f.o.b. Gottenburg, nett cash.				
Pig	—	—	—	—
Bar, rolled	10 10/	—	11 0/	11 10/
Do. hammered	10 10/	—	11 0/	11 10/
Billets	12 0/	—	13 10/	—
Horse Nail Rods	12 10/	13 0/	14 0/	14 10/
Belgian Iron— f.o.b. Antwerp, less 2½ per cent.				
Bars and Slit Rods, common Best Best Best Hammered Puddled Steel Bessemer Hoops Rails Rolled Girders	Nominal.			
Steel—				
Best cast	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear	45 0/	—	45 0/	—
Do. single do.	38 0/	40 0/	38 0/	40 0/
English spring med. quality	12 0/	22 0/	12 0/	22 0/
Blister	21 0/	34 0/	21 0/	34 0/
Swedish keg	16 0/	—	16 0/	—
Milan	25 0/	28 0/	25 0/	28 0/
Bessemer rails	6 5/	—	6 5/	—
Do. tires	11 0/	15 0/	11 0/	15 0/
Do. billets	7 10/	10 0/	7 10/	10 0/
Do. ingots	7 0/	8 0/	7 0/	8 0/
Spiegeleisen—				
Manganesian, best	6 0/	6 10	6 0/	6 10/
Common, and white, per ton	5 0/	5 10/	5 0/	5 10/
Scrap (per ton)—				
Old rails for remanufacture, D.H.	4 0/	—	4 0/	—
Ditto flange or bridge	4 0/	—	4 0/	—
Engineers' scrap	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal	2 0/	3 0/	2 0/	3 0/
Old steel scrap	3 15/	4 10/	3 15/	4 10/
Wire—				
Best best drawn killed gal. tel., Nos. 0 to 6	14 10/	—	14 10/	—
Do. 7 & 8	15 10/	—	15 10/	—
Do. 9	16 5/	—	16 5/	—
Do. 10	17 0/	—	17 0/	—
Do. 11	17 10/	—	17 10/	—
Do. 12	18 10/	—	18 10/	—
Rolled black fencing wire (per ton) 1 to 4	8 0/	—	8 0/	—
Do. 5	8 15/	—	8 10/	—
Do. 6	9 0/	—	9 0/	—
Do. 7	9 10/	—	9 10/	—
Bright Iron Wire (Charcoal wire, 4s. 6d. per bundle extra) per bundle of 63 lb. 0 to 6	0 10/6	—	0 10/6	—
Do. 7 to 8	0 11/	0 11/3	0 11/	0 11/3
Galvanised, 80s. per ton extra. Best best annealed drawn fencing wire, per ton 0 to 6	9 15/	—	9 15/	—
Do. 7	10 5/	—	10 5/	—
Do. 8	10 10/	—	10 10/	—
Castings (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 1½ to 2in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 ,, 4	6 2/6	6 5/	6 2/6	5 5/
Do. 5 ,, 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 ,, 16	6 0/	6 2/6	6 0/	6 2/6
Do. 18 ,, 24	5 17/6	6 0/	5 17/6	6 0/
Bolts and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	11 10/	21 0/
Washers	19 10/	21 10/	19 10/	21 10/

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* The entire ton consists of ten times 100 kilogrammes, or about 30 lb short of an English ton.

OILS, CHEMICALS, &c.

	JANUARY 1. £ s.	£ s.	JANUARY 8. £ s.	£ s.
OILS (per ton)—				
Olive, Malaga..	—	—	—	—
Do. Gioja	—	—	—	—
Do. Levant	—	—	48 0/	—
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	46 0/	—	48 0/	—
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	—	31 0/	—
Seal, yellow	27 0/	30 0/	28 0/	—
Seal, brown	25 0/	—	26 0/	—
Sperm head	70 0/	—	70 0/	—
Cod	27 0/	—	27 10/	—
Whale, pale	27 0/	—	27 0/	—
Do. yellow	26 0/	—	26 0/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	32 0/	—	31 15/	—
Do. brown	30 0/	30 5/	30 0/	30 5/
Foreign Pale	—	—	—	—
Ground nut and Gingelly Madr.	—	—	—	—
Palm oil, fine	36 0/	36 10/	36 0/	36 10/
Palm nut oil	36 0/	36 10/	32 0/	37 0/
Linseed oil	28 0/	—	28 0/	—
Cotton seed oil	29 0/	30 5/	29 0/	30 5/
Lard	44 0/	—	44 0/	—
Cocoanut, Cochin	39 0/	—	31 0/	—
Do. Ceylon	37 5/	—	36 10/	—
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3 6	—	0 3/6	—
OIL CAKE (per ton)—				
Linseed, Ldn.	11 4/	—	11 5/	—
American bls.	10 17 6	—	10 17/6	—
Do. bags	11 12 6	—	11 12/6	—
Marseilles	9 2 6	—	0 2 6	—
Rape, English	4 12 6	—	5 2 6	—
Do. Foreign	—	—	—	—
Green Cotton	6 2 6	—	6 0/	—
TALLOW—PYC.	45 0/	—	45 0/	—
S.Americn. Beef	—	—	—	—
Do. Sheep	—	—	—	—
Australian Beef	35 10/	—	35 10/	—
Do. Sheep	37 10/	—	37 10/	—
Rough Town Fat	14 0/	—	14 0/	—
PETROLEUM—				
Fine (per gal.)	0 0/7¼	—	0 0/6 7-16	—
Do. spirit	0 0/6⅞	—	0 0/7½	—
TURPENTINE—Spirit—				
French	—	—	—	—
American casks	1 11/9	1 2/	1 11/9	1 2/
WHALEFINS (per ton)—				
Davis' Straits	1100 0/	—	1100 0/	—
Arctic	1000 0/	1000 0/	1000 0/	1000 0/
Southern	500 0/	—	500 0/	—
BRIMSTONE (per ton)—				
Rough, 2ds Ind.	7 0/	—	7 0/	—
Do. 3rds, do	5 7/6	—	5 7/6	—
Roll	8 15/	—	8 15/	—
SULPHUR, Flour	11 0/	—	11 0/	—
ACID, (per lb.)				
Acetic, fine	0 0/3½	0 0/4	0 0/4	—
Do. common	0 0/2½	—	0 0/2½	—
Citric	2 0/	—	2 0/	—
Muriatic fine (per cwt.)	0 4/	0 6/	0 4/	0 6/
Do. common	0 4/	—	0 4/	—
Nitric	0 0/4¼	—	0 0/4¼	—
Oxalic (per lb.)	0 0/5	—	0 0/5	—
Sulphuric, concentrated	0 0/0¾	0 0/1	0 0/0¾	0 0/1
Do. Brown	0 0/0¾	—	0 0/0¾	—
Tartaric Crystal	0 1/6½	0 1/7	0 1/6½	0 1/7
Do. Pulv.	0 1/6½	0 1/7	0 1/6½	0 1/7
AMMONIA—				
Carbonate, per lb.	0 0/6½	0 0/6	0 0/6½	0 0/6
Sulphate, White & grey (per ton)	20 0/	—	20 0/	—
ARSENIC—White Lump (per ton)	24 0/	—	24 0/	—
Powdered, do.	10 15/	—	11 5/	—
Bleaching powder	8 0/	—	8 0/	—
BORAX, Rfd., do.	1 17/	1 18/	2 0/	2 1/
COPPERAS (ton)	2 5/	2 10/	2 5/	2 10
BI-SULPHIDE CARBON (per ton)	24 10/	26 0/	24 10/	26 0/
PORTLAND CEMENT—				
1st quality, in cks 400 lb. gross, inc. csks., f.o.b., Thames, per csk	0 9/	—	0 9/	—
Do. in sks, 200 lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.				
Charlton White Paint (per cwt.)	1 12/	—	1 12/	—
Calley's Torbay Paint, Brown	0 30/	—	0 30/	—
Do. Red	0 34/	—	0 34/	—
HYPOPHOSPHITES (per lb.)—				
Iron	0 9/3	0 10/	0 9/3	0 10/
Lime	0 5/3	0 7/	0 5/3	0 7/
Magnesia	0 9/	0 9/	0 9/	0 9/
Manganese	0 9/	0 9/	0 9/	0 9/
Soda	0 5/3	0 6/	0 5/3	0 6/
LEAD (per cwt.)—				
Acetate, best	1 18/	—	1 18/	—
Nitrate	1 14/	—	1 15/	—
Red	0 19/6	—	1 1/	—
White	1 3/	1 4/	1 1/	1 2
LITHARGE (pr cwt.)	0 19/	—	0 19/	—
LIME (per ton)—				
Acetate, Grey, 85 %	19 0/	—	0 18/6	—
Do. Brown 70%	11 0/	11 5/	12 0/	—
POTASH—				
Bichromate (lb.)	0 0/7	—	0 0/7	—
Chlorate (pr. lb.)	0 0/7¾	—	0 0/7¾	—
Muriate, 80% ton	5 17/6	—	6 15/	—
Pruss. Red (lb.)	0 1/8	0 1/10½	0 1/11	—
Do. Yel. lb.	0 0/10¾	—	0 0/11¼	0 1/
Sulphate, 80% (per ton)	9 0/	10 0/	14 0/	16 0/
SALTPETRE (per cwt.)—				
Engl. refnd. kgs.	1 7/6	—	1 7/6	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 1/6	0 19/6	1 1/6
SODA—				
Ash ...... deg.	0 0/1 15-16	0 2/	0 0/1 15-16	0 2/
Bicarb. (per cwt.)	0 11/	—	0 10/3	—
Caustic, 60 %	—	—	0 11/9	—
Do. 72 %	—	—	0 14/6	—
Nitrate	0 18/	—	0 19/6	—
Crystals (per ton)	3 12/6	—	3 12/6	—

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* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

LIFE OF RAILWAY MATERIALS.—The following figures, showing the average life in years of sundry items of railroad materials and equipment, have been compiled from the returns of 29 railroads in the State of Illinois, and will form a part of the forthcoming report of the railroad and warehouse board of commissioners of the State:—Locomotives, 16.91 years; passenger cars, 13.98; stock cars, 9.00; freight cars, 10,80; iron rails, 7.30; steel rails, 14.67; oak ties, 6.77; pine ties, 3.75; hemlock ties, 5.41; cedar ties, 4.75; truss bridges, 9.20; trestle bridges, 7.78; pile bridges, 8.45; joint fastenings, 7.62; telegraph poles, 9.50; fencing, 8.65.

THE BOARD OF TRADE RETURNS

OF the exports of iron, steel, and other metals, with coal, coke, and patent fuel, from the United Kingdom during the month of December, 1879, as compared with that of 1878. Also the exports for the twelve months of 1879.

ARTICLES, AND TO WHAT COUNTRIES EXPORTED.	Dec., 1878.	Dec., 1879.	12 Mnths., 1879.
IRON—PIG.	Tons.	Tons.	Tons.
To Germany ...	8,179	4,157	236,565
Holland ...	23,179	2,307	211,371
Belgium ...	7,130	6,570	83,733
France ...	7,034	5,489	84,432
United States ...	3,617	45,390	270,998
British N. America ...	26	2,401	31,182
Other countries ...	11,389	14,503	301,343
Total ...	60,554	80,817	1,217,624
BAR, ANGLE, BOLT AND ROD.			
Russia ...	620	270	5,481
Germany ...	292	819	5,225
Holland ...	215	210	3,414
France ...	8	13	324
Italy ...	2,053	1,600	14,693
Turkey ...	1,257	2,029	11,732
United States ...	119	7,341	21,630
British N. America ...	1,359	1,083	26,830
,, India ...	3,946	2,066	36,831
Australia ...	2,521	1,078	22,240
Other countries ...	6,333	6,675	84,384
Total ...	18,753	24,177	232,826
RAILROAD, of all Sorts.			
To Russia ...	2,819	562	38,487
Sweden & Norway ...	47	50	14,331
Denmark ...	—	4	5,046
Germany ...	24	13	3,500
Holland ...	2	1,210	8,114
Belgium ...	—	3	28
France ...	—	9	114
Spain and Canaries ...	2,320	1,236	14,321
Italy ...	557	2,011	36,707
Turkey ...	1	—	1,030
Egypt ...	51	1,476	2,957
United States ...	—	7,056	44,998
Brazil ...	444	664	31,913
Peru ...	8	240	2,050
Chili ...	70	5	833
British N. America ...	213	5	64,423
,, India ...	4,162	12,409	88,142
Australia ...	6,420	2,010	55,049
Other countries ...	2,366	6,895	50,062
Total ...	19,501	35,877	463,035
WIRE OF IRON OR STEEL (except Telegraph Wire) ...	3,525	3,498	37,759
HOOPS, SHEETS, & PLATES ...			
To Russia ...	393	576	11,919
Germany ...	294	677	8,074
Holland ...	194	498	7,091
France ...	172	103	2,235
Spain and Canaries ...	561	414	5,087
Italy ...	1,653	1,030	10,941
United States ...	63	3,678	10,456
British N. America ...	311	803	8,914
,, India ...	2,207	2,161	32,700
Australia ...	2,722	3,228	31,462
Other countries ...	5,332	5,266	65,489
Total ...	13,902	18,446	191,489
TIN PLATES.			
To France ...	287	221	5,449
United States ...	7,889	14,262	155,795
British N. America ...	316	439	5,865
Australia ...	375	124	2,425
Other countries ...	2,260	1,360	28,315
Total ...	11,157	16,392	197,849
CAST OR WROUGHT IRON (except Ordnance).			
To Russia ...	1,063	267	8,697
Germany ...	548	447	8,855
Holland ...	971	386	8,196
France ...	308	417	5,077
Spain and Canaries ...	1,067	574	8,387
United States ...	568	1,362	10,403
Peru ...	140	356	2,101
Brazil ...	300	451	31,087
British N. America ...	171	781	8,823
,, Possessions in S. Africa ...	667	1,021	16,141
,, India ...	3,506	1,665	38,174
Australia ...	4,646	3,353	51,056
Other countries ...	4,142	5,107	59,518
Total ...	18,007	17,117	261,015
OLD IRON (for re-manufacture).			
To United States ...	276	45,981	177,842
Other countries ...	361	2,649	45,936
Total ...	637	48,630	223,778
STEEL, UNWROUGHT.			
To France ...	229	301	3,134
United States ...	464	2,683	9,305
Other countries ...	1,416	1,359	18,433
Total ...	2,109	4,343	30,872
MANUFACTURES OF STEEL ...	913	1,038	11,237
Total of Iron & Steel ...	149,148	250,335	2,879,884
HARDWARE AND CUTLERY.	£	£	£
To Russia ...	7,565	8,948	85,506
Germany ...	19,367	14,002	164,670
Holland ...	6,295	7,858	78,837
France ...	11,033	15,632	140,124
Spain and Canaries ...	8,098	9,647	91,023
United States ...	20,838	30,129	335,760
Spanish West India Islands ...	5,874	2,945	81,299
Brazil ...	22,080	20,829	220,477
Argentine Republic	7,684	6,547	87,366
British N. America ...	6,241	7,016	110,749
,, India ...	22,032	21,877	254,491
Australia ...	39,400	28,407	441,441
Other countries ...	80,288	81,991	918,521
Total ...	262,655	255,128	3,019,264
MACHINERY AND MILL-WORK.			
STEAM ENGINES.	£	£	£
To Russia ...	10,551	4,666	224,786
Germany ...	14,308	22,241	224,001
France ...	4,371	13,516	100,256
Spain and Canaries ...	9,425	16,756	170,840
Italy ...	1,075	20,054	100,880
Egypt ...	1,566	445	26,312
Brazil ...	1,875	8,044	88,803
British India ...	41,132	21,676	290,851
Australia ...	23,921	19,866	266,182
Other countries ...	38,821	58,329	699,631
Total ...	147,945	187,033	2,191,504
OTHER DESCRIPTIONS.	£	£	£
To Russia ...	55,487	80,518	1,323,612
Germany ...	66,185	60,876	711,311
Holland ...	14,568	13,314	18[illegible],222
Belgium ...	20,028	20,337	218,195
France ...	41,527	37,655	483,001
Spain and Canaries ...	21,616	13,440	224,257
Egypt ...	2,194	7,121	66,559
United States ...	17,897	20,406	180,702
British India ...	38,014	21,595	300,892
Australia ...	36,516	13,997	321,218
Other countries ...	89,988	91,315	1,078,188
Total ...	406,020	380,574	5,099,197
BRASS, MANUFACTURES OF (not being ordnance) ...	Cwt. 5,185	Cwt. 5,541	Cwt. 78,891
COPPER, UNWROUGHT			
To Germany ...	1,872	2,285	52,523
Holland ...	1,370	3,080	37,292
Belgium ...	2,934	1,652	21,528
France ...	14,822	3,309	148,932
United States ...	40	3,760	4,521
British India ...	471	—	24,976
Other countries ...	2,220	3,494	35,615
Total ...	23,729	17,551	327,387
WROUGHT.			
To Russia ...	2,012	3,018	51,240
Germany ...	717	780	7,321
Holland ...	1,134	479	8,565
France ...	508	123	5,033
Italy ...	830	414	7,070
Turkey ...	2,203	2,078	46,164
Egypt ...	101	486	11,207
United States ...	—	7	512
British India ...	6,963	6,067	90,010
Other countries ...	6,098	6,098	79,052
Total ...	20,532	21,060	308,039
MIXED OR YELLOW METAL SHEATHING...	16,536	24,442	331,742
Total Copper ...	60,797	63,051	967,168
LEAD.	Tons.	Tons.	Tons.
To Russia ...	10	13	10,491
Germany ...	83	59	1,053
France ...	25	138	3,189
United States ...	90	224	1,047
China and Hong Kong...	546	235	5,932
British India ...	366	190	3,317
Australia ...	235	149	3,186
Other countries ...	484	574	8,590
Total ...	1,840	1,582	37,007
TELEGRAPHIC WIRE AND APPARATUS	£ 10,756	£ 20,660	£ 2,502,050
TIN, UNWROUGHT.	Cwt.	Cwt.	Cwt.
To Russia ...	140	68	13,674
Germany ...	751	867	14,326
France ...	2,787	3,656	30,370
Turkey ...	202	125	2,289
United States ...	3,472	1,769	31,944
Other countries ...	2,085	1,734	31,741
Total ...	9,437	8,228	124,353
ZINC OR SPELTER...	6,122	8,622	112,137
COAL, COKE, CINDERS, AND PATENT FUEL.	Tons.	Tons.	Tons.
To Russia ...	24,966	19,499	1,250,766
Sweden & Norway ...	67,599	114,944	1,097,105
Denmark ...	73,691	100,792	775,023
Germany ...	115,528	114,311	2,055,387
Holland ...	22,352	18,712	420,517
France ...	206,305	325,837	3,317,578
Spain and Canaries ...	72,681	85,281	875,129
Italy ...	87,058	132,450	1,370,661
Turkey ...	19,443	19,127	248,335
Egypt ...	52,094	49,707	523,892
Brazil ...	24,106	22,559	313,985
Malta ...	28,924	14,442	330,139
British India ...	28,963	72,452	757,949
Other countries ...	183,674	252,919	5,100,105
Total ...	1,102,386	1,343,632	16,435,642
COAL, &c., for steamers engaged in foreign trade ...	333,304	343,049	4,401,120

EXPORTS OF FOREIGN AND COLONIAL METALS AND ORE

FOR the month of December, 1879, as compared with the corresponding month of 1878. Also the foreign exports for the twelve months of 1879 as compared with 1878.

ARTICLES.	QUANTITIES.			
	Dec., 1878.	Dec., 1879.	12 Mnths., 1878.	12 Mnths., 1879.
	Tons.	Tons.	Tons.	Tons.
Copper, unwrought or part wrought ...	898	975	12,719	17,837
Iron and Steel:—				
Iron: Bar ...	4,450	5,813	60,365	48,927
Steel: Unwrought ...	222	597	3,804	3,234
	lb.	lb.	lb.	lb.
Quicksilver ...	312,189	70,187	2,157,461	2,153,263
Tin, in blocks, ingots, bars, or slabs, and regulus ...	cwt. 6,639	cwt. 18,143	cwt. 131,810	cwt. 176,873

ARTICLES.	VALUE.			
	Dec., 1878.	Dec., 1879.	12 Mnths., 1878.	12 Mnths., 1879.
	£	£	£	£
Copper, unwrought or part wrought ...	58,412	69,814	856,782	1,103,595
Iron and Steel:—				
Iron: Bar ...	40,120	51,167	515,415	425,832
Steel: Unwrought ...	2,832	5,947	48,847	34,537
Quicksilver ...	26,172	7,148	193,596	187,271
Tin, in blocks, ingots, bars, or slabs, and regulus ...	20,844	76,656	417,370	626,679

The quantity and value of iron and coal exported during December, 1879, compared with the same month of 1878.

Years.		Quantity.	Value.
		Tons.	£
Iron …	1879	250,335	1,808,504
	1878	149,148	1,235,113
Increase		101,187	£573,496
Decrease		—	—
		Tons.	£
Coal …	1879	1,343,032	584,797
	1878	1,102,386	504,007
Increase		—	—
Decrease		240,646	£80,790

IMPORTS OF METALS AND ORE

For the month of December, 1879, as compared with the corresponding month of 1878. Also the imports for the twelve months of 1879 as compared with 1878.

Articles.	Quantities.			
	Dec., 1878.	Dec., 1879.	12 Mnths., 1878.	12 Mnths., 1879.
Copper:—Ore—	Tons.	Tons.	Tons.	Tons.
From Chili … …	102	49	2,349	461
C. of Good Hope…	2,531	2,053	12,789	13,629
Brit. N. America…	3,241	351	34,630	25,054
Other countries …	2,928	4,471	53,177	48,685
Total …	8,802	6,924	102,945	87,829
Regulus (incl. Precipitate)				
From Chili … …	610	2,063	11,455	15,666
Other countries …	2,139	3,711	21,955	30,264
Total …	2,749	5,774	33,410	45,930
Unwrought or part wrought				
From Chili … …	1,560	3,030	22,785	33,534
Australia …	118	305	8,651	9,845
Other countries …	297	544	7,914	3,291
Total …	1,975	3,879	39,360	46,670
Iron and Steel—				
Iron: Ore … …	82,069	102,315	1,173,860	1,083,692
Bar … …	5,094	9,505	102,742	95,458
Manufactures …	cwt. 160,515	cwt. 185,001	cwt. 2,114,384	cwt. 2,246,718
Steel: Unwrought …	tons. 175	tons. 908	tons. 4,600	tons. 5,199
Lead, pig and sheet …	9,021	8,462	100,233	102,140
Pyrites of Iron or Copper, or Sulphur ore … …	42,564	43,891	577,719	481,622
Quicksilver … …	lb. 319,281	lb. 742,890	lb. 3,232,618	lb. 3,079,682
Tin, in blocks, ingots, bars, or slabs, and regulus …	cwt. 23,267	cwt. 25,855	cwt. 332,885	cwt. 336,017
Zinc, crude, in cakes …	tons. 2,484	tons. 2,687	tons 32,750	tons. 34,180
Manufactures of, unenumerated … …	cwt. 38,744	cwt. 22,532	cwt. 324,155	cwt. 309,495

Articles.	Value.			
	Dec., 1878.	Dec., 1879.	12 Mnths., 1878.	12 Mnths 1879.
Copper:—Ore—	£.	£.	£.	£.
From Chili … …	2,215	550	30,694	8,355
C. of Good Hope…	45,550	30,570	241,373	232,956
Brit. N. America…	15,601	1,880	191,305	127,581
Other Countries…	31,753	39,905	451,561	395,005
Total …	95,119	81,905	915,133	764,497
Regulus (incl. Precipitate				
From Chili … …	14,304	63,825	342,363	415,996
Other Countries…	76,804	129,309	798,574	1,073,160
Total …	91,108	193,134	1,140,937	1,489,156
Unwrought or part wrought				
From Chili … …	92,907	186,514	1,434,403	1,957,049
Australia …	7,336	20,832	610,640	638,632
Other Countries…	19,291	37,113	513,232	207,494
Total …	119,534	244,459	2,558,275	2,803,175
Iron and Steel—				
Iron: Ore … …	79,522	103,124	1,161,638	1,037,719
Bar … …	51,726	81,017	1,017,239	877,217
Manufactures …	133,809	140,295	1,710,775	1,722,749
Steel: Unwrought …	2,517	9,805	65,472	60,034
Lead, pig and sheet …	143,656	146,231	1,818,676	1,531,801
Pyrites of Iron or Copper, or Sulphur ore… …	92,899	93,157	1,332,934	1,051,015
Quicksilver … …	28,362	73,359	302,919	344,491
Tin, in blocks, ingots, bars, or slabs, and regulus …	72,829	112,104	1,041,026	1,148,973
Zinc, crude, in cakes …	42,647	51,610	611,050	562,293
Manufactures of, unenumerated … …	4,477	23,726	385,865	346,653

PRICES CURRENT OF MANUFACTURED GOODS

OF

BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

The continued rise in iron has had the effect of further sending up prices for all kinds of heavy hardware. First comes gas tubes, which, since the declared rise in marked iron, have been reduced in discount 5 per cent. all round. Ordinary gas tubes, which in August were quoted from 72½ to 75 per cent., are now only 60 to 62½ per cent. Malleable cast nails are advanced 1s. per cwt., and expected to go up further, on account of the extraordinary rise in hematite pig-iron, and of its scarcity. Messrs. Nettlefolds have reduced their discount off patent countersunk clout nails 2½ per cent. The cut tack makers have reduced their discounts 2½ per cent. on wrapped tacks, but those in bags are not yet altered. The mortise lock makers of Willenhall and Wolverhampton have advised an advance of 5 per cent. again. This is the second advance, and is now equal to the rise in rim and dead locks. The oddwork makers have advanced the prices of tinned and black iron oddwork, the discount on those sold by gross being reduced 2½ per cent., while tinned angle brackets, sold by weight, are advanced to quite 15 per cent. Japanned and bright cupboard locks are advanced 3d. per dozen, and japanned presslocks 4d. per dozen. Improved chest handles now stand at 2½ per cent. less discount than a month ago. Patent jute and other sash lines are reduced in discount 2½ per cent. Japanned iron and other bolts are officially advanced, and the new lists are out, but these have been hard to get under the discount now quoted for some time; our lists were altered a week or two ago. Prices of American patent pins are advanced from the first instant. Quotations for gas tubes now stand as follows:—Gas tubes, 60 to 62½ per cent.; fittings, 62½ to 65; water tubes, 50 to 52½; fittings, 52½ to 55; iron steam tubes, 45 to 47½; fittings, 50 to 52½; galvanised iron gas tubes, 45 to 47½; fittings, 47½ to 50; lap-welded boiler tubes, 4½ to 50 per cent.

[By Telegraph.]

The attendance on 'Change to-day was great, and meeting excited; impossible to arrive at correct prices. The market, however, was much stronger. The award of Mr. Chamberlain was published; puddlers raised 1s., and millmen's wages 10 per cent. Marked iron was unaltered, and stands at £9; pig-iron same as last week, but Bessemer advanced again.

ABRIDGED LIST.

Axles, 15 to 25%; coach ironwork, 10 to 15%; coach and waggon springs, 15 to 20%; Augers, 10 to 20%. **Axes.**—Ship carpenters', /5½ to /6 per lb.; Kent and house carpenters', /5 to /6; ditto, steel polished, /5½ to /7; felling axes, /4½ to /4¾; polished, /4½ to /6; bright and blued solid steel, /7 to /8; American felling or wedge Axes, steel polished, 1/ to 1/4 per lb.; common **Anvils**, 84 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard **Bellows**, 42½ to 50%; Best extra nailed Bastard, 37½ to 45%; Best improved long Bristol, 35 to 40%; casters' or moulders', best extra nailed, 12 inch, 30/ per doz. net; common **Smiths' Bellows**, 45 to 50%; Best warranted, extra leather double nailed, 36 to 40%; with movable pipe for shipment 2½% less discount. **Bed screws**, 6 and 7-16 and ⅜ inch, 10/6 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and ⅜ inch nuts, 12/0 to 13/9; Black welded heads, 9/3 to 10/3; common slit heads, 6 and ⅜ and ¼ inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and ⅜ inch, 12/0 to 13/0; black notched heads, 10/6 to 11/6 per gross; **Brass head nails**, 40 to 42½%; star head, 35 to 40%; Brass plated countersunk head, 25 to 30%; **Blacksmiths' tongs**, 26/ to 28/ per cwt.; real fine wrought **Box irons**, 20 to 25%; fine cast, 42½ to 60%; middle cast, 42½ to 60%; charcoal box irons—Victoria, 45 to 50%; ordinary charcoal box irons, 55 to 70%; **Bolts**—Straight tower; solid end tower, 67½ to 70%; end Best solid tower, 62½ to 67½%; solid end barrel brass knob, 62½ to 65%; japanned Scotch tower bolts, 47½ to 55%; painters' brushes, 45 to 65%; Best, 10 to 40%; light galvanised **Buckets**, 12 inch, 38 lb. to the doz., 10/ per doz. net; **Blind cord**, list price net; **Bed hooks and eyes**, 50 to 55% malleable, 62½ to 67½%; Brass chain **Beading**, 30 to 35%; Brass and plate coach beading, 30 to 35%; ashpan moulding, 20 to 30%; **Bottle jacks**—Linwood's, 15 to 20%; Salter's, 30 to 35%; Nicholas's, 15 to 20%; common painted **Beams**, 35% to 65%; Bright round end beams, 40% to 55%; Bright box end beams, 40 to 55%; deep **Copper scales**, 45 to 65%; **Steelyards**, 40 to 60%; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30%; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/9 to 5/9; 28 lb., 5/ to 8/ each, net; **Bedsteads**, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 feet 6 inches, 8/6 to 10/6 each, rising /6 for every 6 inches. **Brass**—Rolled brass, 2 to 12 inches wide, to 30 W.G., /9½ to /10½ per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., /9½ to /10½ per lb.; **House bells**, brass rough, /10 to 1/1 per lb.; turned edge, /11½ to 1/1; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/0 to 1/10; ship and turret bells best, 1/4 to 1/5 **Battery kettles**, 150/ per cwt.; composition sheathing and **Slating nails**, /10¾ to /11½ per lb.; Brass **Escutcheon pins**, ⅝ by 16 inch, W.G., /10½ to 1/. **Brass jelly pans**, with bails, 1/ to 1/1; without bails, 1/1 to 1/2 per lb. **Maslin kettles**, cast, 4 to 16 inch, /10½ to 1/ per lb. **Pinpoints**, 1/3 to 1/4. Brass **Rivets** for boots, 12 to 17, W.G., /9½ to /10½ per lb. Brass **Shoe Bills**, 1/1 to 1/2 per lb. Brass **Scale pans**, 2/ to 2/2; Brass **Toddy kettles**, 15 to 20%. Brass **Tubes**, plain rough, ⅜ inch and above, /10¾ to /11 per lb. Locomotive and marine boiler tubes, seam less from 1⅜ to 4 inch outside diameter, to 14, W.G., /8½ to /9.

Copper.—**Copper boat nails**, wrought 1½ by 12 inch, W.G., and upwards, /10½ to 1/1 per lb. Copper 1 boat **Roves**, ½ inch and upwards 1/2½ to 1/3 per lb. Copper **Brads and bills**, same price as tacks. Light round Copper **Kettles**, bare rivets, 1/11½ to 2/ per lb. Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/3 to 2/4 per lb.; oval bare rivets raisedown, 2/5 to 2/6 per lb. Copper **Rivets** and washers, 1/ to 1/1 per lb.; Copper **Slating nails**, cut, 1 to 1½ inch and upwards, /11½ to 1/ per lb.; Copper **Scale pans**, 1/11 to 2/2 per lb.; cut Copper **Nails and tacks**, 1 inch and upwards, 1/ to 1/1 per lb.; wrought Copper nails and tack, 1/5 to 1/6 per lb.; Copper **Wire**, 0 to 20 W.G., /10½ to /11. Brass **cupboard turns**, 45 to 52½%; **Chair webbing**, No. 9, 4/5; 10, 4/8; C9, 4/1; C10, 4/6 per gross of 66 yards; **Carpet rings**, 1/ to 1/6 per gross; **Cornice poles**, 2¼ inch, brass best burnished, 4/6 per foot, 25 to 35%, 3/4 covered; brass poles, 1/2 per foot, 25 to 35, imitation mahogany cornice poles with ends and rings complete, 2¼ inch, 1/ per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2¼ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30%; wood cornice pole rings, 2¼ inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 22/ to 25/ per gross net; machine made wire **Chain**, single link, iron, 50 to 55%; double link, iron, 45 to 50%; single link, brass, 45 to 50%; registered double link, brass, 40 to 45%; close link brass Chain, 15 to 20% brass oval lamp Chain, 30 to 35%; brass Clock Chain, 30 to 35%; japanned pillar Chains, 1 yard, 16 by 6, 6/8 to 7/6 per doz.; japanned manger, 1½ yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6; japanned dog, 1½ yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/; **Cowties**, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; bullock chains, ⅜ inch hook at each end, 17/ to 13/ backbands, 17/6 to 20/; short link Chain, plain or twisted, ⅜ inch, 16/ to 17/; ½ inch, 13/ to 14/; 1 inch, 12 to 13/ per cwt.; Cart and plough traces, 18/6 to 20/6 per cwt. **Chesthandles**, improved japanned, 75 to 77½%; broad plate, strong and extra strong, 15 to 55, according to strength; railway **Cotterpins**, 55 to 60%; Brass **Curtain rings**, 37½ to 42½%; Brass **Chair nails**, 40 to 45%; square box **Coffee mills**, 25 to 50%; Common post Coffee mills, 20 to 30%; best brass bushed mills, 40 to 45%; London mills, 35 to 40%; registered **Coffin furniture**, 50%; Common, 75%.

Door springs, X, 75 to 80%; XX, 70 to 72½%; XXX, 65 to 67½%; XXXX, 55 to 60%; brass circular and iron circular, 55 to 60%; brass reliance, 10 to 15%; climax, 5 to 10%; universal, 50 to 60%; paragon, 10 to 15%; smiths', 10 to 15%; O'Connor's patent lever hinge springs, 10 to 15%; O'Connor's vertical spring hinge door spring, 15 to 25%; Gerish's spring hinges, iron, 20 to 25%; brass, 10 to 15%; japanned **Door chains**, 30 to 60%.

Files, 25 to 50%; **Frying pans**, best, 60 to 62½% common, 67½ to 70½%; kitchen **Fireirons**, in sets, /5½ to /6½ per lb.; tongs only, /6 to /6½; pokers only, /5¼ to /5¾ per lb. **Fish hooks**, 30 to 35%, best; common, 50 to 55%; light kitchen **Fenders**, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 27/ to 28/ per doz.; bright fronts, 30/6 to 33/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 9 inches to 3 feet 3 inches, 36/6 to 40/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 41/6 to 45/. Cut wire **Fencing staples**, 0 to 6, 18/ to 20/ per cwt.

Gridirons, London pattern, fluted, 62½ to 65%; light ditto, 62½ to 67½%; hanging round bar, 50% to 55%; doublet, 37½ to 42½%; round bar /1½ per bar, 57½ to 62½%; best fluted bar, 55 to 62½%; flat bar, 57½ to 62½%; common flat bar, 57½ to 62½%; common Gridirons, /1, /1½ and /2 per bar, 65 to 70%; **Goffering tongs**, two prongs, 5/6 to 6/6 per doz.; **Gimblets**, 10 to 15%.

Holdfasts, japanned, 20/ to 21/ per cwt. **Hammers**, platelayers' keying, 33/ to 35/; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stonemasons' hand, 2 to 6 lb., 28/6 to 30/6; pin maul, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners, not steeled, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50%; patent hasps and staples, 20 to 25%. **Cast hinges**, polished joint light patent tariff butts, 200, 45 to 50%; 333, 42½ to 47½%; 564, 35 to 40%; polished joint, best best butts, best best, 45 to 50% ditto light tariff, broad butts, 45 to 50%; best heavy, broad butts, 30 to 35%; **Patent Hinges**, edge butts, light, 60 to 65%; strong, 42½ to 55%; patent Scotch butts, 55 to 57½%; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 55%; extra strong bed hinges, 45 to 57½%; patent chest, 50 to 60%; patent strap, 50 to 57½%. H Hinges, 42½ to 57½%; HL hinges, 42½ to 57½%; japanned and garnett hinges, double washered, light and strong, 40 to 45%; best best patent London or Lancashire tees, 55 to 62½%; patent light japanned Scotch Tees, 57½ to 65%; light patent hooks and hinges on plate and to drive, 22½ to 32½%; weighty patent hooks and hinges, weighty Gothic, 19/6 to 24/6; scolloped edges, not japanned, 20/6 to 23/6; Scotch japanned, Tees double washered, 19/ to 22/; Gothic Scotch japanned, Tees 21/6 to 26/6; Gothic Scotch, Tees self colour, 16/ to 23/. **Wrought hinges**, common and best, 37½ to 42½%; best best, 32½ to 37½%; heavy wrought hinges, common black, 14/ to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 19/; japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; japanned broad eye fancy, 21 to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 26/ per cwt.; **Lancashire hinges** wrought, 32½ to 37½%; **Pressed hinges**, common, 62½ to 65%; best, 52½ to 57½%; common brass butt hinges, 1½ inch sanded, 15/ to 18/ per gross, pairs net; very light, 1½ inch, 9/6 to 12/ per gross, pairs net; **horseshoes**, fullered fore, 17/6 to 19/; fullered hind, 18/6 to 19/6; stamped, fore, 17/6 to 19/6; hind, 17/6 to 19/6. **Hollowware**, 45 to 50%; common to best, enamelled, 20 to 25%, delivered in Liverpool, London.

Ironfoundry, general.—Ash grates, 10/ to 12/, air bricks, 2/9 to 3/6, half, single, 3/6 to 4/3, double, 6/3 to 7/; bars and bearers, 8/6 to 9/6 per cwt.; barrow wheels, 9/ to 10/; bake pans, 9/6 to 10/5; cart bushes, 10/6 to 12/6; camp ovens, 9/ to 11/; cooking stoves, 11/6 to 12/6; cogs for blocks, 16/ to 18/; cellar grating, 9/6 to 11/6; clock weights, 8/ to 10/; Dutch stoves, 10/ to 12/; dumb bells, common, 8/ to 10/; best best japanned, 18/ to 20/; frying pans, cast handles, 11/6 to 13/6; frying pans with wrought handles, 16/ to 18/; furnaces, up to fifty gallons, /3½ to /4; galvanised furnaces up to fifty gallons, /11 to 1/2 per gallon; furnace doors, 11/ to 13/; furnace grates, 8/6 to 19/6; forge backs, 11/6 to 12/6; heaters for box irons, 7/6 to 9/6; heaters for urns, 9/ to 10/; jack wheels, 17/ to 19/; oven doors and frames, 11/ to 13/; pots, three legged, Danish, plumbers', and Nego, 9/ to 11/; plumb bobs, 12/6 to 14/6; pudding pans, 12/6 to 14/; pump spouts, 13/ to 15/; sash weights, 7/6 to 8/6 ditto, with pulleys, 10/ to 12/; shoe anvils, 10/6 to 11/6; slippers 11/6 to 12/6; **Italian irons**, 35 to 50%.

Netting, wire, galvanised, 57½% to 60½%, delivered **Cast nails**, lath, 9/6 to 11/ per cwt.; cast wall nails 8/6 to 11/ per cwt.; cast headed bills, ⅝ by 8 ounce, 14 to 15/; fine round cast bills, ⅝-inch, 13/ to 15/; strong round cast bills, ⅝-inch, 12/ to 15/; cast slate pegs, 12 to 16/; cast garden loops, 14/ to 16/ per cwt., all at works. **Patent wrought nails**, 32½ to 37½% per thousand and 27½% those sold as weighty by the cwt.; **patent machine-made horse nails**, 25 to 30%; **cut-nails**, clasp, clout or rose nails, 3 inch and upwards, 10/ to 11/6 per cwt.; cut lath nails, 1 inch and upwards, 13/ to 14/6; cut flooring brads, 2½ inch and upwards, 10/3 to 11/9; fine cut tacks, ½ inch, 34/ to 38/ per cwt.; ⅝ inch 30/6 to 33/6; 1 inch, 26/6 to 28/6 per cwt.; fine cut joiners' brads, or strong, 1½ inch, 15/ to 17/; 2 inch, 14/ to 16/6; 2½ inch, 14/ to 15/; 3 inch, 13/ to 14/6 per cwt.; cut shoe bills, strong, or 12 W.G., 12/6 to 14/6 per cwt.; middle, or 14 W.G., 12/ to 14/; fine, or 15 W.G., 14/6 to 16/6; fine cut tacks, per packet, 75 to 80%; fine cut brads, per packet, 62½ to 65%; **wrought nails**, long count, 15 to 20%; wrought nails, May, 1826 list, to 32½ 37½%; **wrought Bromsgrove nails**, March, 1878, list, 15 to 17½%; best countersunk clout nails 1, inch, 33/6 to 35/6; 2 inch, 24/ to 25/6; 2½ inch, 20/ to 23/6; best best countersunk and **half-countersunk horse nails**, fine beat; Swedish charcoal iron, 15/6 to 16/6% list prices; wrought rose or deck-head **spikes**, 4 inch, 13/6 14/; 5 inch, 13/6 to 14/; 6 inch, 13/ to 14/; fine, /6 to 1/ per cwt. extra; galvanised, 7/ to 8/ per cwt. extra; **wrought rose nails** for India, 2 inch, 10 lb., 19/6 to 20/6; 2½ inch, 13 lb., 18/ to 19/; 3 inch, 20 lb., 17/ to 17/6; **malleable nails**, coffin nails, black, 35 to 40%; white lacquered and gilt, 25 to 30%; sacking; moulders' nails and chaplets, 1½ inch to 3 inch, 27/ to 28/; bright nuggets, 27/6 to 28/; tile pegs, 14/ to 15/ per cwt.; bright nails, 4/ to 5/ extra; tinned nails, 12/ to 13/ extra; galvanised nails, 10/ to 12/ extra; **nuts**, square forged, untapped, ¼ inch, /10 to 1/ per gross; ½ inch, 25/ to 26/ per cwt.; ¾ inch, 23/ to 24/ per cwt.; square forged nuts, tapped, ¼ inch, 1/2 to 1/4 per gross; ½ inch, 30/ to 32/; ¾ inch, 27/ to 29/; forged hexagon, untapped, ¼ inch, 1/10 to 2/; ½ inch, 32/ to 34/; ¾ inch, 27/ to 29/; forged hexagon, tapped, ¼ inch, 2/2 to 2/4; ½ inch, 39/ to 42/; ¾ inch, 31/ to 33/; machine-made nuts, square untapped, ½ inch, 20/ to 22/; ¾ inch 18/ to 20/; 1 inch, 18/ to 20/; square tapped, ½ inch, 25/ to 26/; ¾ inch, 23/ to 25/; 1 inch, 24/ to 26/; machine-made hexagon nuts, untapped, ½ inch, 21/ to 30/; ¾ inch, 22/ to 24/; 1 inch, 22/ to 24/; hexagon tapped, ½ inch, 35/ to 36/; ¾ inch, 30/ to 32/; 1 inch, 28/ to 30/.

Traps, bow spring, sham Dorset and real Dorset rabbit traps, 45 to 65%, list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2½ inch, 4/ to 8/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45%; hawk or pole traps, 54 to 60%; wrought mole traps, japanned, 2/6 to 3/9; galvanised, 3/9 to 4/9. **Tin plates**, I C, 25/ to 26/. **Tinmen's machines** and tools, 5%; brass **Bell Tube**, ⅜ inch and upwards, 1/ to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50% list; **Patent cased Tube**, 45 to 50%; cut to lengths, 40 to 45%; burnished and lacquered brass tube, 30 to 35%; polished and lacquered twisted brass tube, 30 to 35%; patent taper iron tube, 30 to 35%; patent cased taper iron tube, 30 to 35%; parallel iron brased tube, 30 to 35%; twisted iron parallel tube, 30 to 35%; patent cased twisted iron parallel tube, 30 to 35%; iron **Gas Tubes**, 60 to 62½%; fittings, 62½ to 65%; iron **Water Tubes**, 50 to 52½%; fittings, 52½ to 55%; iron **Steam Tubes**, 45 to 47½%; fittings, 47½ to 50%; galvanised iron gas Tubes, 45 to 47½%; fittings, 47½ to 50%; lap-welded **Boiler Tubes**, 47½ to 50%, delivered in London, Liverpool or Glasgow; table catches, 36 to 40%; ditto, improved brass follow, 20 to 25%; wrought japanned **Tea kettles**, 50 to 60%; galvanised **Turnip skips**, 21 inches, light, 25/ to 26/ per doz.

Washers, light iron, 72½ to 75%; heavy washers, 13 to 16 lb., W.G. 9/ to 10/ per cwt.; ¼ inch thick, 2/ per cwt. extra; 5-16 inch, 3/; ⅜ inch 4/; shook bright washers, 3/ to 3/6 per cwt. extra; **Wall hooks**, 23/ to 25/ per cwt.; **Washing tubs**, galvanised oval, 22 inch, 19/ to 30/; 24 inch, 34/ to 35/; round, 22 inch, 38/ to 40/; **Water bowls**, hammered, list price, 52½ to 57½%; light seamed 9 inch, 8/ per dozen; light wired 9 inch, stamped, 11/ to 12/; **Wove wire** list price, iron, copper and brass, 45 to 50%; iron **Wire**, bright, 0 to 6, 10/6 to 11/ per cwt.; galvanised, 14/6 to 15/6; fine galvanised iron wire, No. 23, 4/8 to 5/ per stone 14 lb.; annealed tinned wire No. 18, 38/ to 4/ per stone 14 lb.; cut tinned bottling wire, No. 22, 4/5 to 5/ per stone 14 lb.; weaving and binding wire, No. 24, 3/6 to 3/7 per stone 14 lb.; bright or annealed fine wire, 23, 5/1 to 5/4 per stone 14 lb. net; cast steel wire, 0 to 6, /9½ per lb.; 20 to 22%; metallic or horticultural wire, 6 to 14, /5½ to /6½ per lb; No. 15, 5¾ to /6; 16 to 20, /5½ to /6½; in 1 lb. rings, 1½ inch diameter, /½ per lb. extra; prepared bright **fencing Wire**, 0 to 6, 10/6 to 11/ per cwt.; annealed drawn fencing wire, 0 to 6, 9/6 to 10/; annealed drawn galvanised, 0 to 6, 14/ to 14/6. Bright or annealed steel, 0 to 6, round or oval 12/3 to 13/ per cwt.; blackrolled, 1 to 4, 8/ to 8/6 per cwt.; galvanised rolled, 1 to 4, 11/3 to 12/ per cwt.

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For Sale in all parts of the country, also Bessemer Billets and Blooms of any size and for all purposes, Old Steel Tyres, either whole or broken, Old Springs, Old Files, Cut Bessemer Scrap and Spring Ends for remelting, English and German Spiegeleisen, Swedish and Russian Steel Iron and Box Ends, Swedish Nail Rods and Bundling Iron.

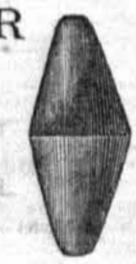
OLD STEEL RAILS.

JOSEPH PARKIN,

IRON AND STEEL MERCHANT, SHEFFIELD.

Importer of Spiegeleisen, Russian and Swedish Iron.

A large stock always on hand of the following Materials:—Double-sawn Rail-Ends of all sections, Old Steel Tyres (whole and broken), Old Railway Springs, Bessemer Blooms and Billets, Plating Bars and ordinary Bessemer Bars, for all purposes; Cut Bessemer Scrap, Spring Ends, &c., for crucible melting. Also large quantities of Bessemer Scrap Rail Ends, Bloom Ends, &c., for (Martin-Siemens) re-melting kept in stock at various Ports for shipment.



NOZZLE AND STOPPER

FOR ORDINARY AERATED WATER BOTTLES,

(Horner's Patent).

The only Patent for utilising old Bottles. Converting them into Patents, saves Corks, Wire and Labour.

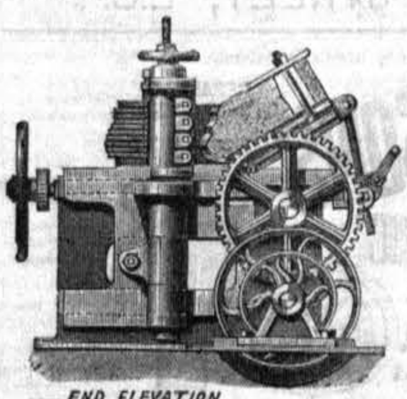
No Leakages. Easily fitted to any Bottle. Nozzle and Stopper can be used again if Bottle breaks. Cost saved in one season.

HOME PRICES.		EXPORT PRICES.	
Nozzles, Stoppers, and Washers,	14s. per gross.	Nozzles, Stoppers, and Washers,	16s. per gross.
Extra, if Nickel Plated Nozzles,	6s. ,,	Extra if Nickel Plated Nozzles,	6s. 6d. ,,
Bottling Machines, £5 5s., £10 10s., £16 16s.		Bottling Machines same as Home.	
Royalty, £5 5s. per annum.		No Royalty.	

SOLE PROPRIETORS—DAVENPORT & CO.,

SODA-WATER AND ICE-MAKING MACHINISTS, 99D, HIGH HOLBORN, LONDON.

Illustrated Catalogues Post Free to all parts of the world.



END ELEVATION

WESTERN & CO.,

CHADDESDEN WORKS, DERBY.

MAKERS OF MACHINERY FOR

Woodworking and Stoneworking,

TIMBER FRAMES, PLANING MACHINES,

MOULDING MACHINES, &c., &c.

MAX WESTERN & CO.,
BELVEDERE ROAD, LAMBETH, LONDON.

WILES'S PATENT LOCK NUT.

ESPECIALLY SUITABLE FOR RAILWAY FISH BOLTS.

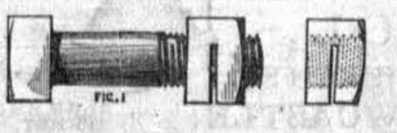


FIG. 1

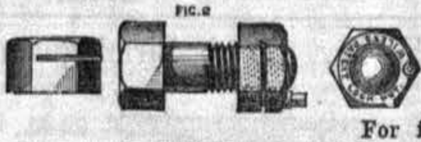


FIG. 2

The advantages of this Lock Nut are as follows:—Simplicity, cheapness, strength, locking on any portion of the bolt without injuring the thread. Fig. 1A shows a RAILWAY FISH NUT with saw-cut partially closed, having been previously tapped, and it is only necessary to screw it upon the bolt in the ordinary manner, when the cut opens and exerts a sufficiently strong spring friction to secure the nut from slacking back by vibration. Fig. 2 shows a nut fitted with set screw, which is more applicable to steam engines and other machinery, especially when the nuts are above 1 inch in diameter, but below that size it is recommended that they should be of steel and applied in the same manner as the fish nut, thereby dispensing with the set screw.

For further Particulars apply to

JOHN F. WILES AND CO.,
18, FINCH LANE, CORNHILL, E.C.

N.B. A large assortment always in stock at Messrs. MOSER & SONS, 178, High St., Southwark, S.E.

S. MOULTON & CO.,

KINGSTON INDIA-RUBBER MILLS,
BRADFORD, WILTSHIRE.

Manufacturers of their Patent Steel Embedded and other India-rubber Springs for Locomotives, Railway Carriages and Trucks, India-Rubber Valves, Sheet Packing, Washer Rings, Hose Pipes, and Tubing, Machine Banding, Waterproof Garments, Blankets; Sheeting, Elastic Hot Water Beds, Cushions, Patent "Moss" Inking Rollers for Printers, Truss Pads, and Umbilical Cones, &c. &c.

ECONOMY.

"If you have an efficient automatic cut-off valve and an automatic steam-tight piston, you are bound to have an economical engine."—Science Lectures.

No more Throttle Valves. No more Leaky Pistons. No Addition to Prime Cost.

For full particulars of the "Turnbull" Cut-off Valve Gear and the Double-action Piston Packing, apply to

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Consulting Engineer, 184, Buchanan-street, Glasgow.

URIAH NICHOLS, ENGINEER,
PERSEVERANCE IRONWORKS,
DUNCAN STREET, OLDFIELD ROAD,
(Removed from Back Quay Street).
MANCHESTER.

MANUFACTURER OF
PATENT VERTICAL, MULTITUBULAR,
AND
CROSS-TUBE BOILERS,
With or without Engines combined.
MORTAR MILLS,
Fixed or Portable for Steam or Horse-power.

PILE DRIVERS,
PUMPS,
EARTH BORING
MACHINES.

STEAM & HAND CRANES,
CRABS,
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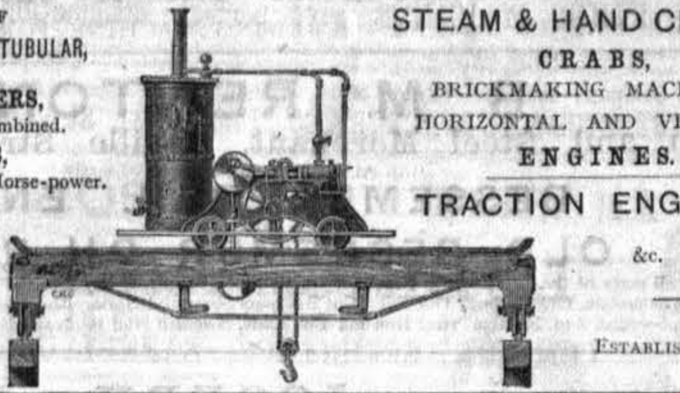
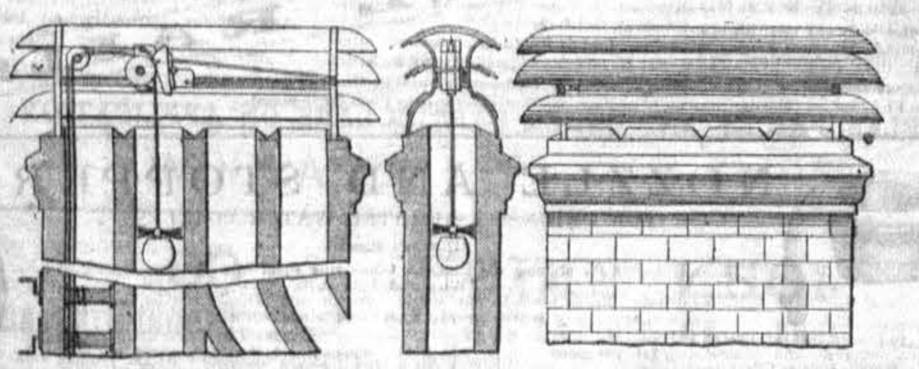
HORIZONTAL AND VERTICAL
ENGINES.
TRACTION ENGINES,
&c. &c.

ESTABLISHED 1830.



PATENT DESIDERATUM
FOR SMOKY CHIMNEYS, AND SWEEPING MACHINE.



A Model of the Apparatus, and a full-sized Machine fitted complete, together with Testimonials, can be seen, and further particulars as to price, merits, &c., obtained on application to Patentee,

WILLIAM ROSS,
2, CRANE COURT, FLEET STREET, E.C.

PARIS, 1878, Class 67, SILVER MEDAL, the only medal awarded.

SPECIAL BRANCH FOR REPAIRING STEAM GAUGES.
CHADBURN & SON'S
PATENT REPLY
ENGINE & STEERING
ENDLESS BAND
TELEGRAPHS.
FITTED ON BOARD VESSELS OF THE ENGLISH, GERMAN, AUSTRIAN, BRAZILIAN, AND TURKISH NAVIES.
ROYAL MAIL STEAM SHIP COMPANIES,
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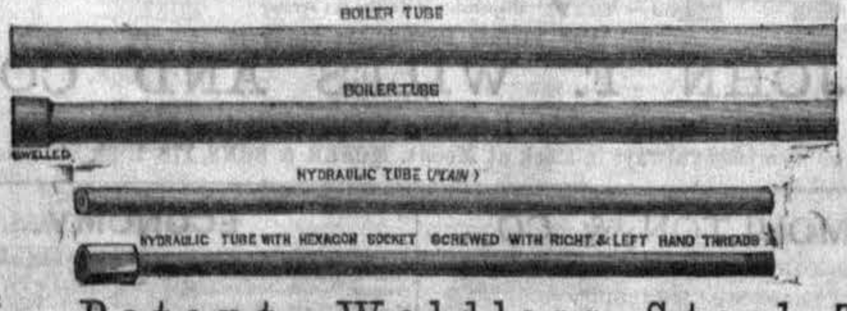
STEAM FACTORY, 11, WATERLOO ROAD.
LIVERPOOL,
LONDON:—96, FENCHURCH ST.
GLASGOW: 2, TAYLOR PLACE, GOVAN ROAD. | NEWCASTLE: 40, BLENHEIM STREET.

The Weldless Steel Tube Company, Icknield Port Road, Birmingham.
MANUFACTURERS OF


BOILER TUBE
BOILER TUBE
SWELLED
HYDRAULIC TUBE (PLAIN)
HYDRAULIC TUBE WITH HEXAGON SOCKET SCREWED WITH RIGHT & LEFT HAND THREADS

TRADE WELDLESS MARK
Patent Weldless Steel Tube
For Boilers for Hydraulic Presses, for Bushes and Collars, Ferrules, Boring Rods, Couplings, Axles and Shafting, Coils, Air Reservoir and other uses.

MESSRS. MATHESON AND GRANT'S ENGINEERING TRADES REPORT.

THE monotony of falling prices is at last broken, and the tide has turned with a strength unexpected by the most sanguine. Although up to the date of our July report the condition of the engineering trade was lower than ever, the causes of the coming change had been in active operation for some months. On the one hand, the lack of opportunities for safe investment which prevails in times of dulness and suspicion, had tried the patience of capitalists long enough; and, on the other, the successive failures of manufacturers who had been selling below cost had at last remedied that over-production and competition which had driven prices down, so that when new enterprises increased the demand in various branches of trade, those who had survived the late ordeal, and who could readily meet the want, were not only fewer but stronger, and prices rose rapidly. At present the change is felt principally among those who deal in raw materials, and who are engaged in the earlier stages of manufacture. But the increased value of commodities is spreading to other branches of the engineering trades, and a general activity is confidently anticipated.

Coal, Iron and Steel.—The enormous output capacity of the collieries has so far fully met the increasing demand, and prices have shared but slightly in the upward movement of iron and steel. Probably from 6d. to 2s. per ton would represent in almost all districts the rise in the selling prices of those coals in which engineers are interested; and this abundance of cheap fuel has allowed all iron and steel making operations to be carried on to an extent otherwise impossible. But the colliers are demanding higher wages, and dearer coal may be looked for almost immediately. Pig-iron, which in the summer had at Cleveland fallen to the price, till then considered impossible, of 32s. per ton, and at Glasgow to 40s., commenced to rise in August, and rapidly attained 50s. and 60s. respectively, and though part of this was due to excessive and speculative dealings, prices are, after some fluctuations, to-day at Cleveland and Glasgow, as given in our list, with no signs of falling. The values of rolled-iron have risen more steadily than those of pig-iron, and from £2 15s. to £3 5s. per ton represents the average enhancement of the various kinds of plates and bars. The trade in iron rails, which had all but disappeared, has shared in the general revival, and rolling mills which seemed to have permanently stopped have been restarted. The fact does not, however, betoken any change in the opinion of engineers about the respective advantages of iron and steel, but the demand for rails to be delivered within a certain time has exceeded the productive power of the steelmakers; and in regard, therefore, to time of execution, as well as to price, the comparison is more favourable to iron than it has been for some time. No present record of the iron trade would be complete without some reference to the increased value of scrap iron. Always a staple trade of some importance in this country, the sudden demand from America, where the protective duties favour the importation of raw or partly finished material, has caused the exportation thither of old rails and heavy scrap at prices above the relative value of the commodity; and railway companies and others in Europe and India who were fortunate holders of such iron, have obtained from American buyers during the last four months prices due, not so much to any intrinsic value as measured by that of the finished article, but almost solely to an artificial Customs tariff, which practically compels the purchase of refuse or waste material in preference to new iron or steel, which at the time the demand arose, might, if the law had allowed liberty of trade, have been purchased at prices but slightly higher. Scrap-iron now fetches £4 10s. per ton, and old rails £5 per ton f.o.b. in England.

In our July report we stated that the prices were then lower than for the preceding 30 years, and were still falling The rebound upwards will be seen from the following list:—

	Per Ton.				
	Jan. 1877.	Jan. 1878.	Jan. 1879.	July, 1879.	Jan. 1880.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Steam coal, f.o.b. at Cardiff	0 10 3	0 9 9	0 8 3	0 7 9	0 8 9
West Hartley Coal, f.o.b. at N'castle	0 12 3	0 11 0	0 8 9	0 8 6	0 8 6
Pig-iron at Glasgow, No. 3	2 17 6	2 11 6	2 3 6	2 1 0	3 6 6
Pig-iron at Middlesborough, No. 3 ..	2 6 6	2 0 1	1 14 6	1 13 0	2 12 0
Iron Ship Plates at Middlesborough	7 10 0	6 5 0	5 15 0	5 5 0	8 5 0
Iron Bdge. Plates in Yorkshire	8 7 6	7 12 6	7 0 0	6 15 0	9 0 0
Steel Ship and Bdge. Plates	—	—	12 0 0	11 10 0	14 0 0
Iron Rails, f.o.b. ..	5 10 0	5 0 0	4 15 0	4 10 0	7 0 0
Steel Rails, f.o.b. ..	7 5 0	0 6 7	5 15 0	4 15 0	8 5 0

Steel Rails have undergone, among the various kindred articles of trade, conspicuous alteration in price, and the causes of this can be seen and measured. Prices had fallen so continuously during the last few years, and buyers had so often found the advantage of postponing their orders, that when an upward movement began, they were at first loth to recognise a new condition of affairs. But when the reality of the change was recognised, the competition of buyers who demanded early delivery of rails had its natural result; and when to the current demands of the English railways, the large purchases of the Colonial and Indian lines were added, the limit of production was soon reached. Taking the total capacity of English steel rail mills at about 800,000 tons per annum, as contracts for delivery within six months exceeded one-third, and seemed likely to reach one-half of this quantity, those makers who were able to offer rails for delivery during the early months of 1880, asked and obtained the present current rates. But these are being received for only a small proportion of the contracts in progress, for the majority were made and are being carried out at the prices of the past six months, namely, between £4 10s. and £6 10s. per ton. The numerous trades which are subsidiary, or preliminary to the rolling of steel, have shared in the advance.

ASBESTOS ENGINE PACKING
AND
MILLBOARD JOINTING.
For STUFFING BOXES and ALL KINDS of JOINTS, give perfect satisfaction.

No higher compliment could be paid to the value of these goods than the fact that they have been more imitated than any article of the kind hitherto in use. Engineers, however, are cautioned that all such imitations are a direct infringement of the Company's Patent Rights, and all parties offering such Packing for sale render themselves liable to proceedings at law.

The Packing and Jointing Manufactured by the Company bear their Trade Mark, without which none is genuine.
PRICE LISTS and all INFORMATION from the PATENT ASBESTOS MANUFACTURE CO., Limited, 31, St. Vincent Place, Glasgow.

Galvanised Corrugated Iron, which had fallen last summer to prices abnormally low, has shared not only in the general rise in the price of iron, but also in that of spelter (zinc).

Ironfounding.—Founders are not, as a class, working profitably, and find it difficult even in some cases even to obtain the higher prices required by the enhanced value of pig-iron.

Bridges and Structural Ironwork, though dearer in price because of the higher cost of iron, have not as yet felt much of the improved demand which is hoped for. Bridges have been and are being ordered for the colonies to a considerable extent.

Iron and Steel Shipbuilding.—The improvement which even a year ago had been felt in the shipyards of the Tyne and the Tees, is now shared by the more northern builders, and all the leading yards in Scotland are fully employed, affording employment in their turn to various subsidiary trades. Part of this activity is due to the continued supersession of sailing ships by steamers, which the low price of steam-coal has encouraged; much also to the replacement of the very numerous cargo steamers lost during the past year: but besides such causes as these is the impetus to shipbuilding which the emulation of the great mail-carrying companies affords. Larger and quicker steamers—many of them of steel—are being built for all the ocean lines, and the mercantile fleet of the country, already far in advance of all rivals, will during the coming year receive an unprecedented increase. Shipbuilding will be encouraged also by the higher rates of freight, which are at the present time affording increased profit to owners.

Mechanical Engineering.—In London and the larger towns engineers have been busier during the last six months, and are generally well employed at good prices; but so much of the work done—especially in secondary trades like that of machine-tool makers, is dependent on the increase of public works and engineering enterprise, that activity generally follows, rather than accompanies, a sudden rise in values such as the present.

Railway works in England are at present confined almost entirely to short connections with existing railways, to the widening of the main trunk lines, and to the extension of station and siding accommodation; but even these works involve very considerable expenditure.

Locomotives and Rolling Stock.—Numerous large orders have been given out, and prices are considerably higher than they were three months ago; but some of the principal makers have still on hand contracts made at very low rates; and the new demands have not yet overtaken the producing power of the country.

Agricultural Implements.—Manufacturers have suffered severely from the bad harvest of the year, and are still exceptionally short of orders, the work at most of the factories being mainly for stock.

In conclusion, those who feared that the depression of the last few years was to be perpetual, have had their doubts dispelled; but foreign competition and the want of reciprocity are still the bugbears of many. But it is more than ever evident that this country, in all that concerns the manufacture of iron and steel, and in the innumerable industries dependent on these metals, has advantages for many years to come over all other countries. Notwithstanding the artificial restraints of protective duties, purchasers will find their way to the cheapest market; and the restrictions and loss which hostile tariffs impose on those who frame them will far more than outweigh in international competition the injury which they inflict on us.

Even at this, the commencement of better times, the causes which lead to reaction are not wanting. The depression in the last few years has been due not so much to any great diminution in the weight or volume of English manufactures as to the extension of factories beyond the demands upon them; and the new iron and steel works already commenced and projected are on a scale which may lead to disappointment and loss hereafter.

32, Walbrook, London, Jan. 1st, 1880.

WEAR IRON WORKS.

For Sale (by private treaty), the valuable and modern PUDDLING FORGES, PLATE MILLS, ANGLE MILLS, and BAR MILLS, known as THE WEAR IRON MILLS, situate at Castletown, near Sunderland, on the north bank of the river Wear, and in close proximity to the shipbuilding yards and manufacturing works on the river.

The works stand on 25 acres of Freehold land, have a good private wharf, and are most advantageously connected by railway with the sources of fuel supply, and the inland markets for finished iron.

The PLANT and TOOLS are very efficient, and the works could be put into operation with a small outlay of time and money, and are capable of turning out 800 to 1000 tons of Shipbuilding Iron, Boiler Plates, and Merchant Bars per week, with space for large increase.

Adjoining there are 174 WORKMEN'S HOUSES, with 10½ Acres of Additional Freehold Land, well adapted for building purposes.

Further particulars, and permission to inspect the property, may be obtained on application to Messrs. H. B. & C. WRIGHT, Solicitors, Sunderland.

J. VEITCH WILSON & CO.'S
LUBRICATING OILS
COMBINE EFFICIENCY, SAFETY AND ECONOMY.

POLAR OILS.
REFINED OILS, ranging in body from Castor Oil, to the finest Sperm Oil, and adapted to every class of machinery, from the heaviest shafting to the lightest spindle. Guaranteed free from any tendency to gum or clog.

CYLINDER OILS.
PURE HYDRO-CARBON OILS specially prepared and adapted for steam cylinders, pistons and valves. Warranted to stand any working temperature without decomposing, and, being absolutely neutral, in no way to affect either metal or packing with which they may come into contact.

CLIMAX OILS.
NATURAL OILS of dark Colour, graduated in body from Castor Oil to Tallow Oil, limpid at 32 deg. Fah. Adapted for stationary and locomotive engines, shafting and heavy machinery, screwing, boring, &c.

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WORKS: 258, DOBBIE'S LOAN,

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COOKLEY IRON AND TINPLATE WORKS, NEAR KIDDERMINSTER.

Manufacturers of BEST, BEST BEST, and CHARCOAL IRON in Bars, Rods, and Sheets; Charcoal and Coke Tin and Terne Plates. Tinned Sheet Iron in all gauges and dimensions up to 96 by 48 inches. Special qualities of Stamping Sheets, Cold Rolled and Close Annealed Iron, Black Taggers, &c., &c.

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WEST GROVE WORKS, HALIFAX.
Patentees and Manufacturers of Wrought Welded Boilers.
FIRE AND BURGLAR PROOF SAFES, &c.
GOLD MEDAL, PARIS, 1878; SILVER MEDAL, PARIS, 1878.
THE ONLY GOLD MEDAL AT ANY INTERNATIONAL EXHIBITION FOR WELDED BOILERS.

SAFES,
STRONG ROOMS,
FIREPROOF DOORS, &c.,
For ordinary and special risks.
DEED BOXES,
CASH BOXES,
DESPATCH BOXES,
PAPER BOXES,
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&c., &c.

FOUR GOLD MEDALS.

Elevation. Vertical Steam Boiler.

FOUR SILVER MEDALS.

SPECIALTIES IN BOILERS.
GOLD MEDAL EXCELSIOR.
INVINCIBLE.
TRENTHAM CORNISH.
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And others of acknowledged merit.
RANGE BOILERS,
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GOODS SUPPLIED THROUGH THE TRADE.

FOR MINING, ENGINEERING AND GENERAL MECHANICAL PURPOSES

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GEO. ANGUS & Co NEWCASTLE-ON-TYNE AND LIVERPOOL.

GOLD MEDAL, PARIS UNIVERSAL EXHIBITION OF 1878.

HORSFALL'S PATENT COMBINED BOLT & NUT FORCING MACHINE

MAKES BOLTS WITH SQUARE, HEXAGON, OR CHEESE HEADS, WHICH DO NOT REQUIRE DRESSING OR FINISHING BY HAND.

OVER 60 OF THESE MACHINES HAVE BEEN SUPPLIED TO ENGINEERS, &c.

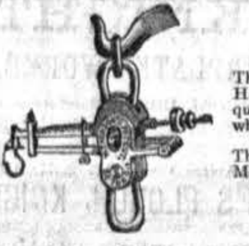
MAKES NUTS, EITHER SQUARE OR HEXAGON, WITHOUT ANY LOSS OF MATERIAL IN PUNCHING.

S. MARSDEN & SON, SOLE PROPRIETORS.

homson's Screw Pulley Block.

MEDAL

In the Supreme Court of Scotland, on 22nd December, 1876, and again in the House of Lords, on 10th July, 1877, judgment was pronounced in favour of THOMSON'S PATENT TUBE EXPANDER, and Dudgeon was found liable in costs.



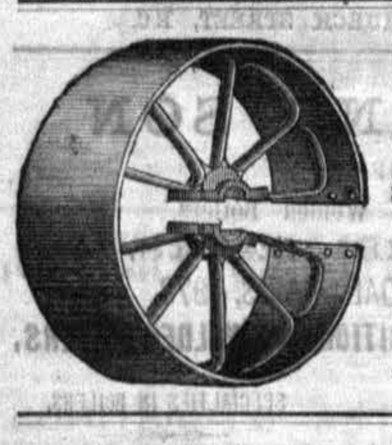
Thomson's Patent Winch, Block or Hoist, will raise a load ten times quicker than his Patent Screw Block, where light lifts are required, say 5, 10, 15, or 20 cwt.

The Suspended Lever Weighing Machine is now largely used in all countries.

COMPEGNIE.

Thomson's Patent Winch Block.

WILLIAM THOMSON AND CO., ENGINEERS,
KINNING PARK, GLASGOW.
Wholesale Agent in London, ALEXANDER R. WRIGHT, 10, St Mary Axe, E.C.



HALF-SPLIT PULLEYS OR SPRING DRUMS.

Simple, Light, Elastic, Strong, Durable & Cheap (Mackie's Patent).

WILLIAM LINCOLNE & Co.

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*. To Save Both Bands and Belting Use "Lt" Belting Syrup. *

Awarded Bronze Medal, Paris Universal Exhibition, 1878.

REVISION OF PRICES. ABOLITION OF ANNUAL LICENSE CHARGE.

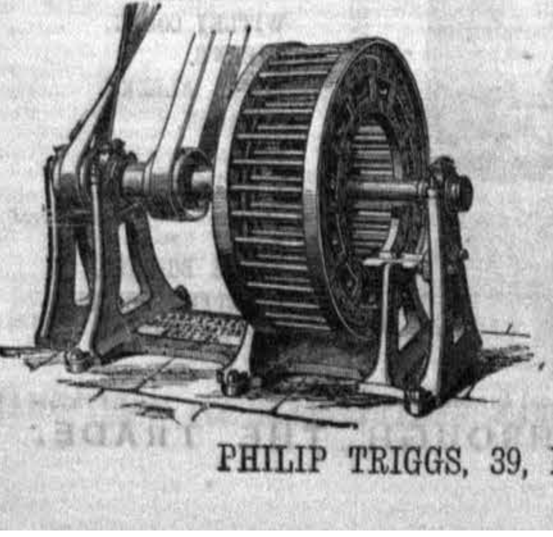
CARR'S PATENT DISINTEGRATOR.

This Machine effectually pulverises by the combined influences of percussion and of centrifugal force, Iron, Zinc, and other Ores, Asphalte, Artificial Manures, Phosphates, Fire Clay and many other substances. It is also largely in use for the pulverisation of coal for the manufacture of Coke, Patent Fuel, &c.; and is very effective for mixing Sugar.

These Machines are capable of reducing to a fine granular powder from 50 to 200 tons per day (according to size) of any unfibrous material. Machines made to order from 18 inches diameter, to suit special requirements of purchasers; these small machines being specially adapted to the requirements of Chemical Manufacturers for Mixing and other purposes.

A Descriptive Pamphlet will be sent free on application to the Managing Trustee of the Estate of the late Patentee,

PHILIP TRIGGS, 39, Broad Street, Bristol.



BICKFORD'S PATENT SAFETY FUSE

FOR CONVEYING FIRE TO THE CHARGE IN BLASTING ROCKS, &c.,

OBTAINED THE PRIZE MEDALS AT THE "ROYAL EXHIBITION" OF 1851; AT THE "INTERNATIONAL EXHIBITIONS" OF 1862 & 1874, IN LONDON; AT THE "IMPERIAL EXPOSITION," HELD IN PARIS, 1855; AT THE "INTERNATIONAL EXHIBITION," HELD IN DUBLIN, 1865; AT THE "EXPOSITION UNIVERSELLE," HELD IN PARIS, 1867; AT THE "GREAT INDUSTRIAL EXHIBITION," ALTONA, IN 1869; AT THE "EXPOSICION NACIONAL ARGENTINA" IN CORDOVA, S. AMERICA, IN 1872, AND (TWO MEDALS) AT THE "UNIVERSAL EXHIBITION" IN VIENNA, 1873, &c.

BICKFORD, SMITH & CO.,
TUCKINGMILL, CORNWALL,
AND
ST. HELEN'S JUNCTION, LANCASHIRE,
MANUFACTURERS AND ORIGINAL PATENTEES OF
PATENT SAFETY FUSES,

Having been informed that the name of their firm has been attached to Fuses not of their manufacture, beg to call the attention of the Trade and Public to the following announcement:—

Every Coil of Fuse manufactured by BICKFORD, SMITH & CO. has Two Separate Threads passing through the Column of Gunpowder, and they claim such Two Separate Threads as exclusively their TRADE MARK.

OIL SUPERSEDED!
NO MORE MESS, NO MORE WASTE.

BLIVEN'S AMERICAN LUBRICATING CREAM

UNRIVALLED FOR ECONOMY, EFFICIENCY AND CLEANLINESS,

For Marine and Stationary Engines, Mill Shafting, &c. &c.

EXTRACTS FROM TESTIMONIALS.

"We are very much pleased with it. Apart from the large saving effected, it is much cleaner, and takes less time and labour than in attending to the oiling of bearings. Tests show 6/8 for Cream, against 45/- for Oil.
"THOMAS BRASSEY and Co., Birkenhead."

"The tests with shaft journals in the joinery department, working at very high speed, show results especially favourable.
"LAIRD BROTHERS, Birkenhead."

"It has given us unqualified satisfaction. Requires much les attention than oil, and is perfectly clean.
"JAMES TAYLOR and Co., Birkenhead.

"We find it to be the most efficient, economical and cleanly lubricant we have hitherto used."
"ALEX. CRICHTON,
"Manager Cork S.S. Company, Liverpool."

"It is the most efficient lubricant we have ever tried.
"J. H. WILSON and Co., Liverpool"

"We enclose order for one ton, which is the best proof we can give you of our satisfaction.
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"Work is considerably lessened, and 60 to 70 per cent. is saved.
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Cattle, Sheep, and Pig Troughs, Cart Bodies, Corn, Flour, and Sack Bins, Funnels, Shoots, Hoppers, Boilers, and every Description of Wrought Iron work either painted or galvanized.

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EARLS COLNE, ESSEX,
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AGRICULTURAL IMPLEMENTS,
Including

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Horse Gears for Thrashing Machines Chaff Cutters. &c.,
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STEEL PENS.
Sold by all Dealers throughout the World.

PATENT INJECTOR.
Fanblowers and Exhausters.
ALL SIZES IN STOCK.
To blow from 3 to 100 Smiths' Fires, and to melt from 8 cwt. to 10 tons Metal per hour.
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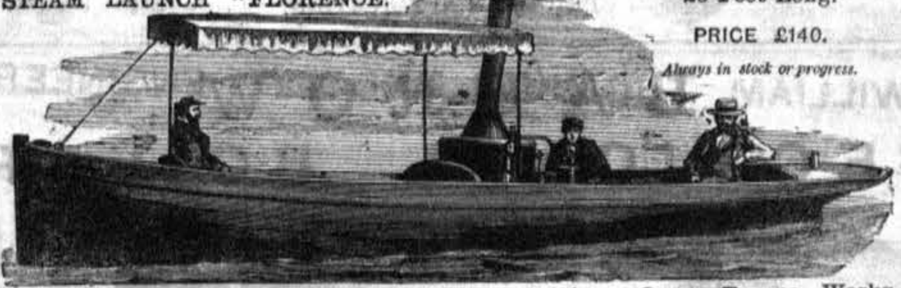

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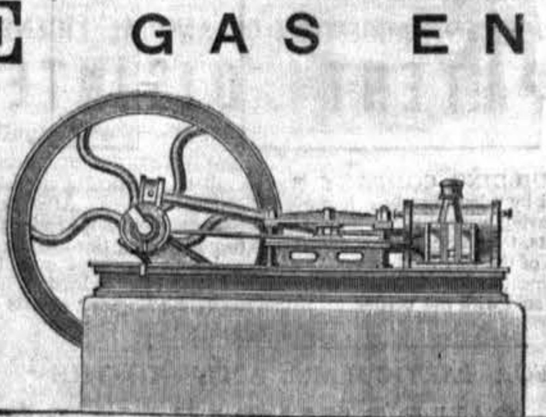

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Locomotive Iron Tubes with Copper Ends.

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For each extra 1 inch in width add 10 per cent. to following prices:

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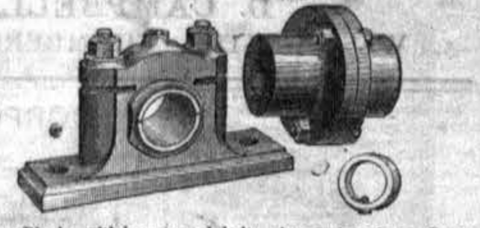
Diameter in inches	6	8	10	12	15	18	21	24	28	32	36	42	48	54	60
Width, ditto ...	2	2	2	3	3	3	3	4	4	4	5	5	5	6	6
Price, Split, shillings ...	8	9	10	11	14	17	20	25	32	38	46	55	66	95	110
Do. Plain do....	5	6	7	8	10	13	16	20	25	30	38	45	55	80	90



Plummer Blocks, with brasses and bolts, planed, bored, &c. Couplings, bored, faced, keywayed, and with turned bolts. Loose Collars of wrought iron bored, turned, and steel screws.

STOCK, SIZES, and PRICES, delivered here.

Bore, in inches to standard	1¼	1½	1¾	2	2¼	2½	2¾	3
PLUMMER BLOCK, ...each	6/	7/	8/	10/	12/	16/	21/	27/
COUPLINGS ....pair	7/	8/	10/	13/	17/	22	28/	35/
LOOSE COLLARS...........each	2/2	2/6	3/	3/6	4/	4/6	5	6/
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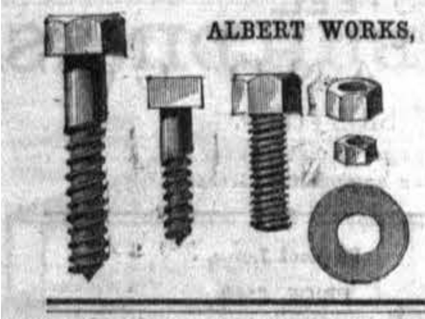
ALBERT IRON COMPANY,

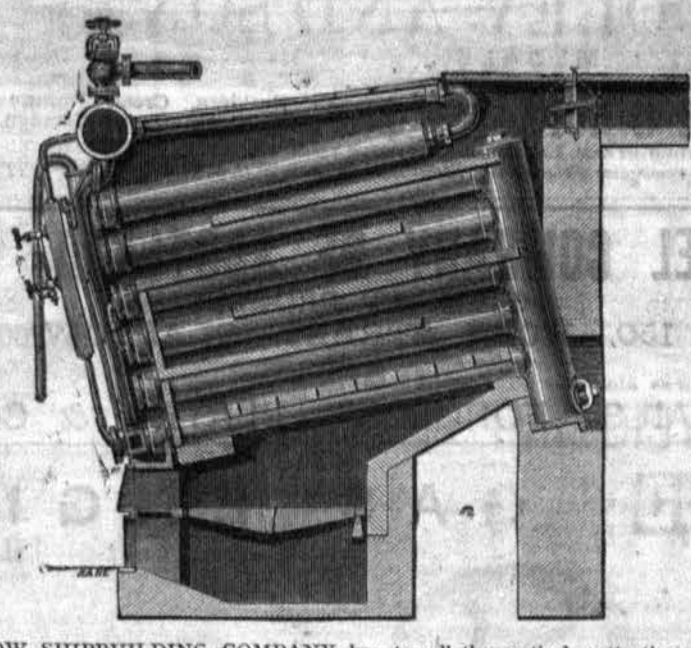
ALBERT WORKS, WHIFFLET, COATBRIDGE, NEAR GLASGOW.



Manufacturers of all kinds of machine and hand-made bolts, nuts, rivets, spikes, washers, wood-screws, &c. Contractors for iron-work. General smiths.

PRICES ON APPLICATION.

BARROW SECTIONAL BOILER.



The BARROW SHIPBUILDING COMPANY beg to call the particular attention of Steam Users to the great advantages to be obtained by adopting their improved Sectional Boilers. After the most careful experiments extending over some years, and having worked these Boilers in their own workshops under the most varying conditions, and subject to the most crucial tests, they have every confidence in recommending them to the public.

The Boilers are constructed of the very best material, combined with the most careful workmanship, every Boiler being tested to 300 lb. per square inch, and made absolutely tight and perfect before leaving the Company's works.

Each Boiler, in addition, is sold with the certificate of the Inspecting Engineer of one of the first Boiler Insurance Companies in the country.

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Zeitschrift für Maschinen- und Mühlenbauer, Ingenieure und Fabrikanten,
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These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour and Gas Companies, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works and the trade generally. They have been in repute for the last thirty years as the BEST PROTECTORS OF WOOD, CEMENT AND IRONWORK; they even stop corrosion on the latter after it has set in and their base being oxide of iron they are free from those properties which make lead paints so destructive to iron. They do not scale, or blister, are not affected by heat, frost, rain or gases, and—unlike most oxide and "anti-corrosive" paints, which are usually so rough and granular as to be fit only for outdoor work—they are UNSURPASSED FOR DECORATIVE PURPOSES, being prepared by patent machinery in a way that ensures A FINE ENAMELLED SURFACE. Their extraordinary DURABILITY and COVERING PROPERTIES have borne the TEST OF A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The colours especially recommended for ironwork are Torbay Brown, Red and Chocolate, Brixham Black, Bronze Green, and Imperial Stone; ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way.

ANY COLOUR MADE TO ORDER.

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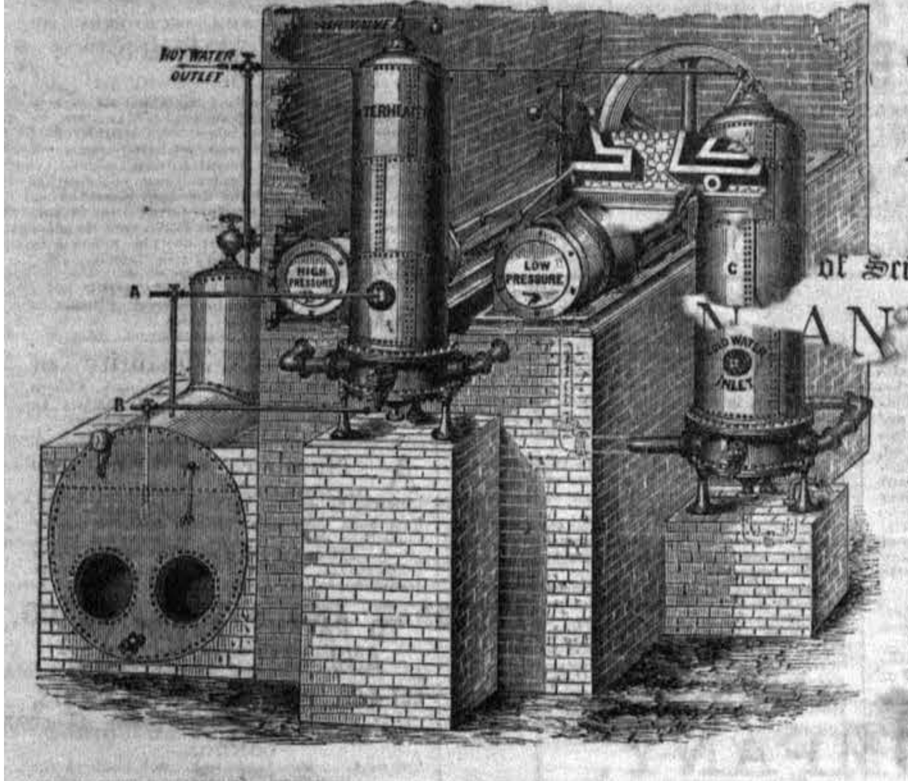

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Sole Makers of Berryman's Improved Patent

UNIVERSAL EXPANDING BRASS TUBULAR HEATER,

AS APPLIED TO HIGH-PRESSURE, CONDENSING AND

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The great success which has attended the introduction of these Celebrated Heaters to High Pressure has led to their being applied to Condensing Engines also, and as Interheaters for Compound Engines—Stationary and Marine; and from actual experience J. W. and Co. have now reliable information as to the precise amount of Saving in Boiler Mending and Coal which can be realised by the judicious use of Exhaust steam from High Pressure, Condensing or Compound Engines with these justly

CELEBRATED BERRYMAN HEATERS.

The Interheater shown in the above sketch is fixed at any convenient distance from the Cylinders, in or outside the Engine-room. The Exhaust steam from the High Pressure Cylinder is passed through the inside of the Solid-drawn Bent Brass Tubes in the Interheater, and thence into the Steam Chest of the Low Pressure Cylinders.

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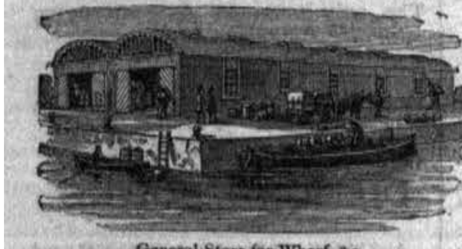

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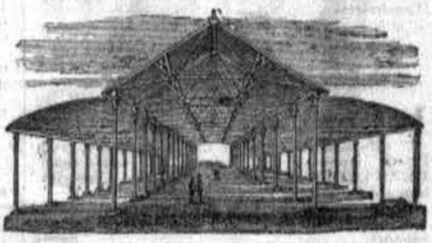
The system adopted by F. M. and Co., in the Construction of their Galvanised Corrugated Iron Buildings combines many advantages which no other form of building can offer. At a minimum cost they provide every required accommodation, while the construction secures great strength and durability, together with protection against fire. Illustrated Catalogues and Estimates sent on application when Purchasers should supply full particulars of requirements.



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Any description of Cotton or Hemp Packing (either round or square) made to order for SHIPPERS AND LARGE BUYERS.

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Manufacturer of Fire Bricks for Steel, Iron, Brass, Gas, Chemical and Glass Furnaces, Copper roasting, calcining and refining furnaces. The special bricks for the Siemens regenerative gas-furnace (this is the brand recommended by Dr. C. W. Siemens). Bessemer tuyeres, runners, plugs and stoppers. Gorman tubes. Gannister of highest quality, ground fireclay. No other firebrick combines such a high degree of infusibility with the perfect absence of cracking and splitting up under sudden cooling.

Each brick bears the registered Trade Mark.

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Head Offices—Albert Square, Manchester.

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In consequence of the effluxion by time of the Copartnery, and Death of one of the Partners, the well-known DENNYSTOWN FORGE WORKS, Dumbarton, are for Sale by Private Treaty.

These Works have been established upwards of 26 years, and have enjoyed a large share of public support.

They are situated in Dumbarton, on the bank of the River Leven, bounded on the East by the North British Railway, (from which there is a branch into the works), and on the West by the Leven, where there is a private quay.

The Ground extends to 4 Acres 10 Poles, or thereby, at the moderate Feu-duty of £52 8s. 4d. The value of the ground has largely increased since the date of the feu.

The Plant is extensive and valuable. There are Seven Steam Engines (large and small), Sixteen Machines in Lathes, Slotters, Screwing Machines, &c.; Nine Steam Hammers, from 15 cwt. to 10 tons; 18 Vertical Boilers. The Cranes are numerous, and of the most improved and powerful description, the Furnaces and all other appliances complete and ample.

These Works are well situated for the receipt of the raw material and the despatch of the finished forgings, having connection by rail to all parts of the country, as well as by water with the various shipbuilding and engineering yards on the Leven and the Clyde.

In the locality there is a large demand for forgings; while the situation of the Works at all times commands a superior class of workmen both skilled and labouring. The Works are now in full employment, and will be continued so for the entry of a purchaser on or before July next.

Messrs. James Ritchie, Maclean and Co., Writers, 175, Hope-street, Glasgow, are in possession of the Title Deeds and Inventories and Valuations, and will furnish all necessary information.

Glasgow, 30th December, 1879.

TO ENGINEERS, &c.

This Corporation being deSIROUS of receiving TENDERS for the Construction and Delivery, at Trinity Wharf, Blackwall, of 200 WROUGHT - IRON OIL DRUMS, of 5 Gallons each, Notice is hereby given, that the Specifications and Forms of Tender may be obtained on application at the Store Department at this House, on any day between the hours of 10 a.m. and 4 p.m. Tenders sealed and marked outside "Tender for Oil-Drum," must be addressed to the Secretary, and delivered at this House on THURSDAY, the 8th inst., and no Tender can be entertained that is not made on the form provided.

The Corporation does not pledge itself to accept the lowest or any tender.

By Order,
ROBIN ALLEN, Secretary.
Trinity House, London, 1st January, 1880.

Engineer Wanted as OutSIDE Manager of a Company established to supply Railway Crossings, Points, Switches, Signals and Interlocking Apparatus. A preference will be given to one who has had practical experience in such work, and who has a connection among Railway Engineers and Contractors. An intimate knowledge of the Board of Trade requirements is essential.

Apply by letter, giving full information and salary expected to Williams Railway Patents Company (Limited), 140, Hope-street, Glasgow.

COUNTY OF DURHAM.
Valuable Colliery for Sale.

To be Sold by Auction, by Order of the Liquidators of the Rosedale and Ferryhill Iron Company (Limited), at the Board Room, Royal Exchange, Middlesborough, on TUESDAY, the 3rd of February, 1880, at half-past Twelve for One o'clock precisely (unless previously disposed of by Private Contract, of which notice will be given), Mr. CHARLES WILLMAN, Auctioneer, the well - known THRISLINGTON COLLIERY, situate near Ferryhill, in the county of Durham, and producing some of the finest hard Coal in the County, known on the London Market as the "South Kelloe Coal;" partly held under Lease, for a term of 63 years, from the 1st of October, 1865, at the certain annual rent of £750, and tonnage rents in addition, and partly held under Lease, for a term of years expiring on the 6th of October, 1884, at the certain annual rent of £1500, and tonnage rents in addition; together with all the necessary Colliery Engines, Gear, and Plant, in full operation; and also upwards of [illegible] ovens, in good repair; also the Farm kn[own as] THRISLINGTON FARM, situate in the [illegible] of Bishop Middleham, in the county of Dur[ham] and containing 300a. 2r. 10p., in the occupation [of] Mr. William Parker as sub-tenant; and held under Lease, for a term of 21 years, from the 1[st] of May, 1865, at an annual rent of £340, and also the several Lands, Buildings, and Cottages, belonging to the Rosedale and Ferryhill Iron Company (Limited), situate near and held and occupied with the above Colliery. The premises may be viewed on application to W. H. Wood, Esq., Mining Engineer, West Hetton Lodge, Coxhoe. Particulars, with Plans and Conditions of Sale, are in course of preparation, and may shortly be obtained from W. H. Wood, Esq., John Marley, Esq., M.E., Darlington; Edward Williams, Esq., Middlesborough; the Liquidators of the Rosedale and Ferryhill Iron Company (Limited), Middlesborough; and from DODDS and Co., Solicitors, Stockton-on-Tees.

Stockton, 1st January, 1880.

The Cheshire Lines ComMITTEE are prepared to receive TENDERS for the supply of the undermentioned PERMANENT WAY MATERIALS, viz.:—

Steel Rails	1200 tons or	1800 tons
Chairs	1175 ,, ,,	2000 ,,
Fish Plates	150 ,, ,,	200 ,,
Fish Bolts	40 ,, ,,	80 ,,
Spikes	50 ,, ,,	150 ,,
Sleepers (creosoted)	Number 36,000 or	62,000
Crossing Timbers (creosoted)	,, 3000 ,,	6000
Telegraph Poles (creosoted)	,, 300 ,,	600
Keys	,, 122,000 ,,	220,000
Ferrules	,, 50,000 ,,	100,000

Patterns can be seen, and Specifications with Form of Tender obtained, upon application to the Committee's Engineer, Mr. W. G. Scott, C.E., Central Station, Liverpool.

Sealed Tenders endorsed "Tenders for..........." to be in the hands of the undersigned not later than 9 a.m. on the 21st inst.

EDWARD ROSS, Secretary.
London-road Station,
Manchester, 2nd January, 1880.

GLAMORGANSHIRE.

To be Sold by Public Auction, in February next (unless previously Sold by Private Contract), Valuable Iron Works, in good working condition, consisting of Four Blast Furnaces, Charcoal Refineries, Forge and Mills, Steam Hammer, and all appliances and necessaries for such work.

The Blast Furnaces are capable of a production of at least 4000 tons per month, and the works are connected by sidings with two railways, giving communication to any part of the Kingdom, and are within 24 miles of the shipping port, as well as being convenient to the Tin Plate Works of Monmouthshire and South Wales.

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Ironstone is worked from the Colliery properly adjoining, and therefore obtainable at a low cost.

For further particulars apply at the Offices of The Wayne's Merthyr Company (Limited),
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THE GREAT NORTHERN RAILWAY COMPANY.—STORES CONTRACT.

The Directors of the Great Northern Railway Company desire to receive Tenders for the Supply of New, and the Purchase of Old Stores for periods of six and twelve months respectively, from the 1st February next. Samples and patterns may be seen at the Office of Mr. Nicholls, the Storekeeper, at Peterborough, from whom also Forms of Tender and Specifications, and every information as to the Contracts may be obtained, on and after the 16th inst. Tenders addressed to the Secretary, sealed and marked on the outside "Tenders for Stores" (specifying the class of Stores tendered for), must be sent to the Offices at King's-cross on or before 10 a.m. on SATURDAY, the 24th January inst. The Directors do not bind themselves to accept the lowest or any Tender.

ALEXANDER FORBES, Secretary.
Secretary's Office,
King's-cross Station, London,
8th January, 1880.

SALE OF IRON CUTTINGS AND PUNCHINGS AT THE ROYAL ARSENAL, WOOLWICH.

The Secretary of State for War is prepared to receive Tenders for the purchase of such IRON CUTTINGS and PUNCHINGS as may be for disposal at the Royal Laboratory, Woolwich, during the period from 16th February, 1880, to 31st March, 1883. Forms of Tender and all information may be obtained on application to the Commissary-General, Royal Arsenal.

The Tenders are to be delivered at the War Office, Pall-mall, London, S.W., by 12 o'clock noon, on FRIDAY, the 23rd day of January, 1880, addressed to the Director of Army Contracts, and marked on the outside "Tender for the purchase of Iron Cuttings, &c."

EVAN COLVILLE NEPEAN,
Director of Army Contracts.
Army Contract Department,
War Office, Pall-mall, S.W.,
5th January, 1880.

THE TAY BRIDGE DISASTER.

At a Public Meeting held in the Town Hall, Dundee, on Wednesday, 31st December, 1879—Provost Brownlee in the Chair—it was moved by the Rev. Dr. Watson, and seconded by Mr. Yeoman, M.P.:—

"That this meeting of the Inhabitants of Dundee desires to express its deepest sympathy with the friends of all those who were suddenly swept into eternity by the stupendous disaster at the Tay Bridge, and that a Committee be appointed to receive subscriptions and to administer the fund that may be subscribed according to the necessities of the case."

Subscriptions will be receiv[ed] by the Treasurer, Mr. Alex. Sc[illegible]k, Dundee, and by [illegible] W[illegible] [illegible]t of Dundee.

LOFTU[S] [illegible] MINES, CARLIN [illegible] YORK-

To be [S]old [illegible] Public Auction, in one lot, [illegible] a going concern, by [C]HARLES [illegible]MAN, C.E.M.E., in the [illegible] [R]oyal Exchange, Middlesborough, [illegible] [illegible]AY, January 27th, 1880, at [illegible] [o'c]lock for noon precisely, subject to such [illegible]ns of Sale as will be then produced.

[illegible] [Th]at Valuable concern known as the "Loftus I[illegible] works and Mines," situate at Carlin How, near Loftus, in the County of York, consisting of two Blast-furnaces, complete in every respect for the output of a maximum make of Cleveland pig-iron, together with the fixed plant.

All the land appertaining to the Blast-furnaces is Leased for 99 years (and consists of 40 acres or thereabouts), from June 30th, 1873, at the aggregate rental of £435 per annum.

The surface land appertaining to the Mines for the due working of the same, comprises two acres or thereabouts, and is Leased for 35 years from 1st December, 1867.

There are 92 workmen's cottages built in close proximity to the works, Leased for 90 years from May 16th, 1873, subject to Ground Rent of £50 per annum. Printed Particulars, Conditions, and Plans may be had on application to the Auctioneer, Exchange-place, Middlesborough; Mr. Robert McCurrack, Royal Exchange, Middlesborough; Mr. T. C. Hutchinson, Newport Rolling Mills, Middlesborough; Mr. Henry C. Duncan, Solicitor, 7, India-buildings, Fenwick-street, Liverpool; or to Mr. George Robinson, Solicitor, Bank buildings, Skipton.

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To be Sold, by Private TREATY, as a going concern, on the Great Northern line of Railway, a well-established ENGINEERING BUSINESS, comprising the following branches, viz.:—

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The Machinery and Tools are by well-known makers, and the new buildings are erected upon lands secured on a 999 years' lease.

Full particulars can be obtained from Mr. Isaac Jenks, of Wolverhampton, or Mr. Thomas Leman, Accountant, Nottingham; or Messrs. Corser, Fowler and Langley, Solicitors, Wolverhampton.

TO ENGINEERS AND OTHERS.

This Corporation being desirous of receiving TENDERS for the CONSTRUCTION and delivery at the Trinity Works, Oreston, near Plymouth, of GUN METAL and other FITTINGS for the new Eddystone Lighthouse, Notice is Hereby Given, that the drawings may be inspected and specifications and forms of tender obtained on application at the Store Department at this House on any day between the hours of ten a.m. and four p.m.

Tenders, sealed and marked outside "Gun Metal Fittings for Eddystone Lighthouse," must be addressed to the Secretary and delivered at this House on MONDAY, the 19th inst., and no tender can be entertained that is not made on the form provided.

The Corporation does not pledge itself to accept or any tender. By order,
ROBIN ALLEN, Secretary.
Trinity House, London, Jan. 6, 1880.

Private Secretary or ConfiDENTIAL Clerk.—Situation wanted as above to a Nobleman or Gentleman by a well-educated young man, age 27. First-class references can be given.—Address, "H. F.," 7, Catherine Street. Strand, London, W.C.

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Prices and Particulars on application to W. GARNER, Boilermaker, Salford, Manchester.

BY ORDER OF THE SECRETARY OF STATE FOR INDIA IN COUNCIL.
INDIAN STATE RAILWAYS.

The Director General of Stores for India is prepared to receive TENDERS from such persons as may be willing to supply fifteen six horse-power PUMPING ENGINES, BOILERS and PUMPS, either of India Office or of any special pattern.

The Conditions of Contract and Specification may be obtained, and the drawings inspected on application to the Director General of Stores, India Office, Westminster, S.W., and Tenders are to be left at his office at any time before Two o'clock p.m., on TUESDAY, 27th January, 1880, after which no Tender will be received.

A. ABERCROMBIE JOPP,
Director General of Stores.
India Office, 7th January, 1880.

Wanted.—A Quantity of Six, Ten and Eleven-inch Flange Pumps for Mining Purposes. Particulars to Edwin Carver, 57, Whitechapel, Liverpool.

A Number of Superior SECOND-HAND PORTABLE ENGINES, by eminent makers, for SALE, which have been thoroughly repaired and are ready for immediate delivery. Can be inspected under steam.—Prices and full particulars on application to Marshall, Sons and Co., Limited, Britannia Ironworks, Gainsborough.

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For terms apply to John Vivian, C.E., Whitehaven, Cumberland.

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Patents.—Mr. J. C. Mewburn, Patent Agent and Consulting Engineer. Patents obtained at Home and Abroad. Designs and Trade Marks Registered. Specifications and Disclaimers prepared. Opinions given on cases submitted. A Handbook, giving full information as to the costs of Patents, &c., post free. Office for Patents, 169, Fleet Street, London.

Inventors should read "How to MAKE MONEY by PATENTS."—The "Engineer" wrote:—"We recommend it as a vade mecum for inventors." Free 14 stamps.—Barlow and Co., 23, Southampton Buildings, W.C.

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LONDON, FRIDAY, JANUARY 16, 1880.

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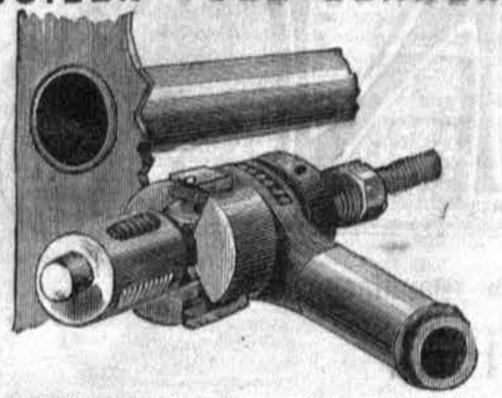

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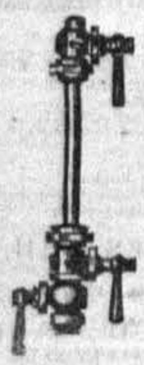

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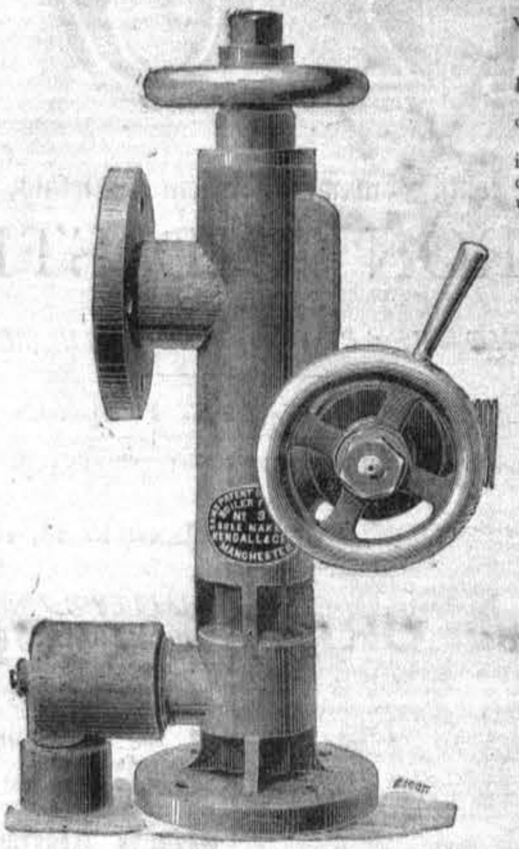

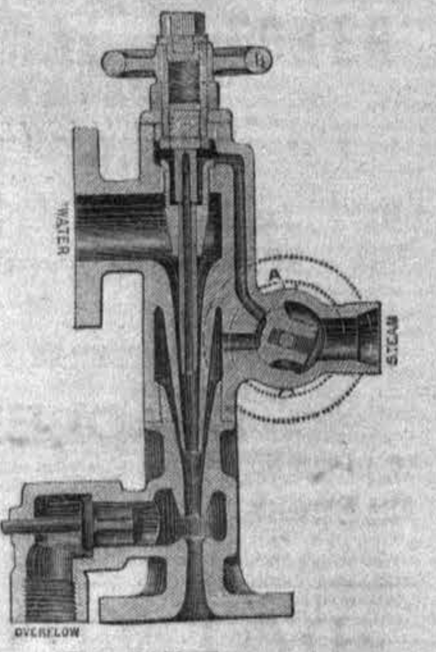

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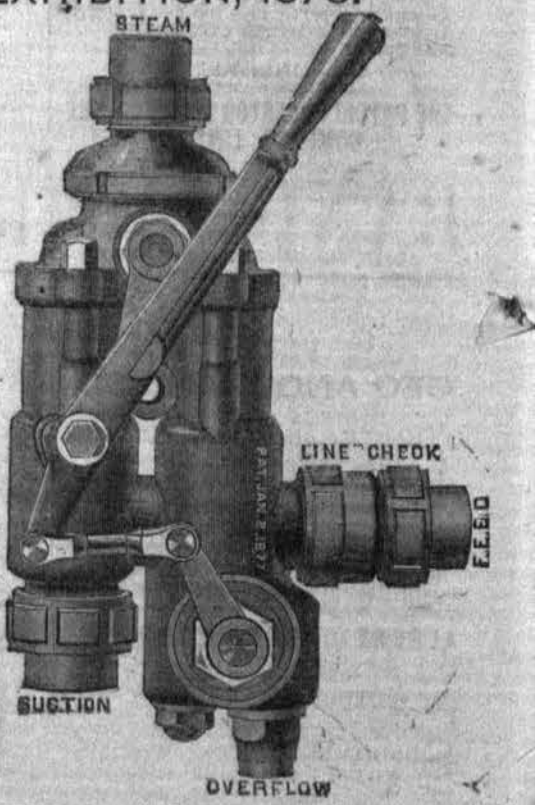

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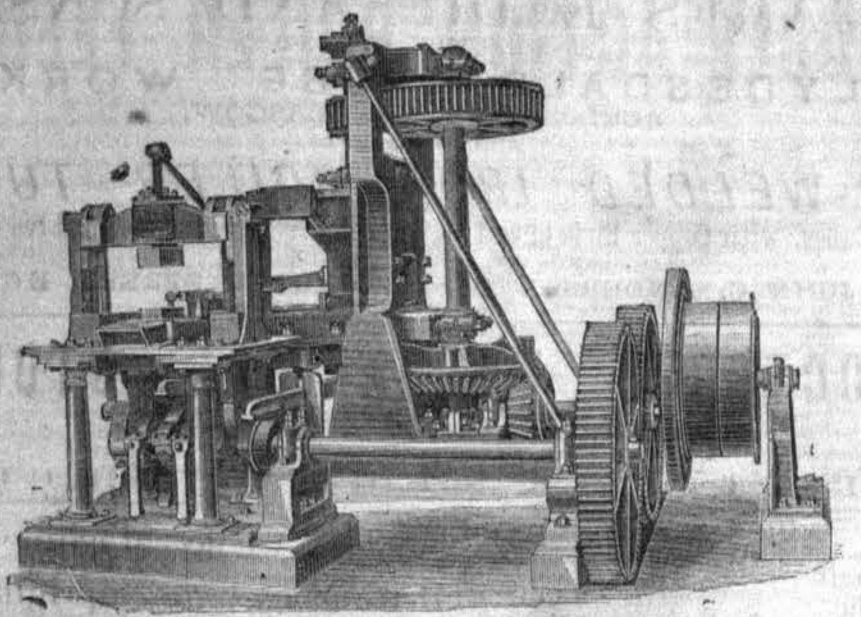

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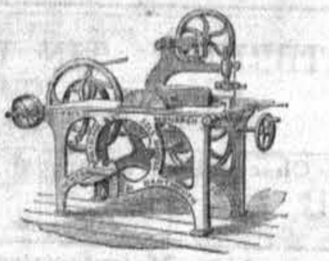

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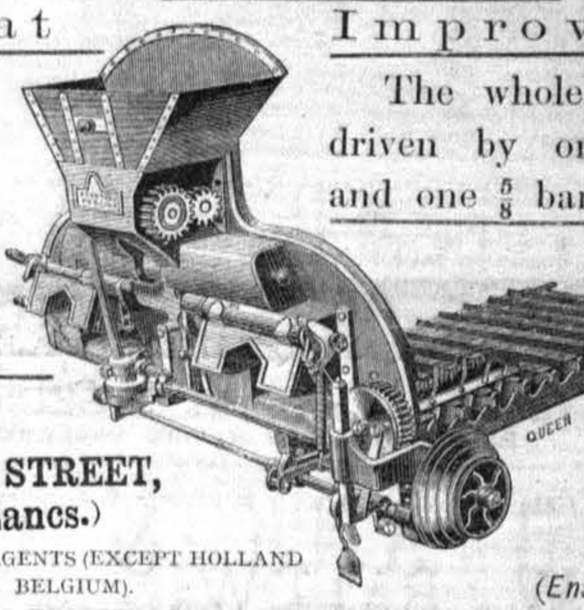

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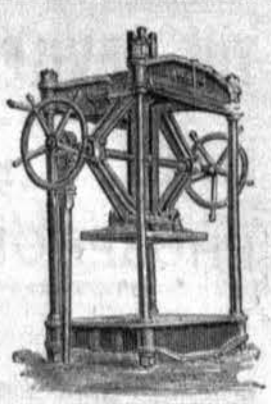

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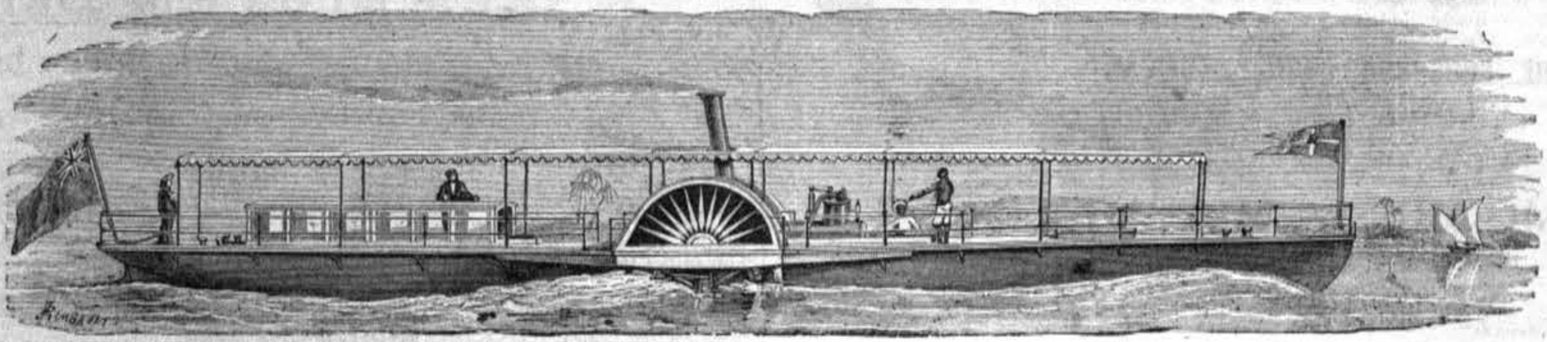

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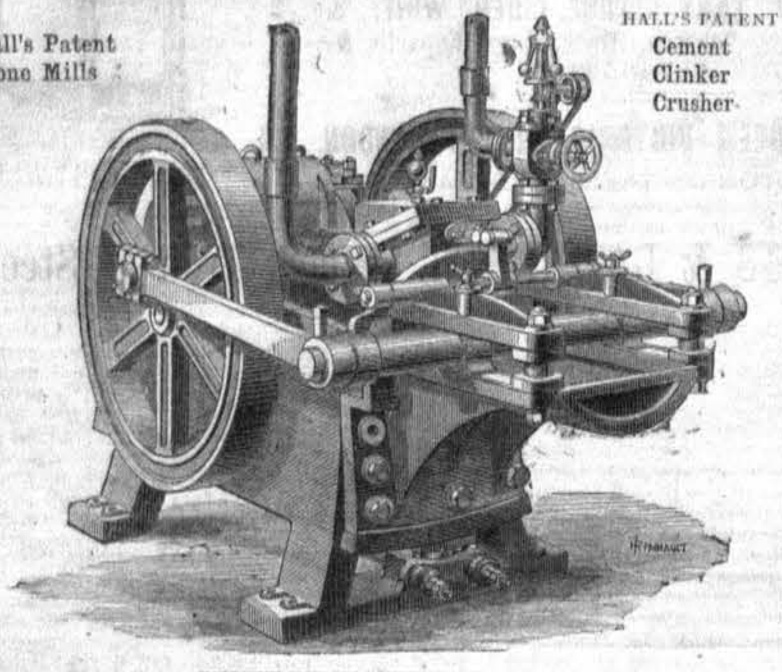

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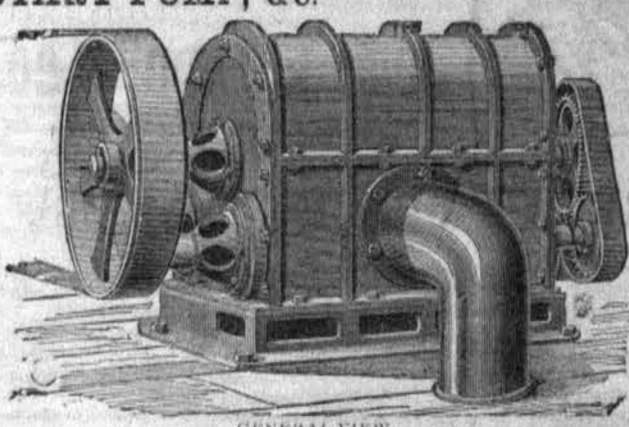

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IRON.

LONDON, FRIDAY, JANUARY 16, 1880.

ELECTRIC LIGHTING.

THE prominence which has naturally been given to public lighting by means of electricity has, to a certain extent, been the cause of several examples of private enterprise in this direction passing with little or no notice. To the public generally these latter examples are as things unknown, as they have, for the most part, only come under the notice of those using the establishments where the electric light has been adopted. Broadly put, it is well known everywhere that the Thames Embankment, from Westminster to Blackfriars, is, and has been for the past thirteen months, lighted by means of electricity on the Jablochkoff system. It is not, however, by any means so well known that there are several extensive private establishments in the metropolis and elsewhere which are, and have been for long past, similarly illuminated, and with equal success. Such, however, is the fact, and the evening of Wednesday last witnessed an addition to the list. This latest example of private lighting on the Jablochkoff system is the establishment of Messrs. Samuel Brothers, of Ludgate Hill, London, where we had the pleasure of inspecting the application of the most recent development of this system on the evening mentioned. The premises are lighted by means of thirteen electric lamps, although there is sufficient battery and engine power for twenty. The lights are distributed as follows:—One in each of the two windows on each side of the principal entrance, two in front of the ground floor, two in the back of this floor, one in the counting house, one over the landing of the large staircase leading to the upper floor, and five in the first floor departments, making up the total of thirteen. The lamps are all suspended from the ceiling at a height of about 8 feet from the floor, and are carried in harp pendants, through which the conducting wires are conveyed to the candles. They contain four Jablochkoff candles, and as each candle lasts two hours, a continuous light for eight hours is therefore provided. The lamps can easily be replenished when the last candle is burning, so that, practically speaking, the light can be made to be continuous for any length of time. The globes are of opalescent glass, and 20 inches in diameter.

The apparatus for producing the currents of electricity consists of a battery of Gramme dynamo-electric machines of the twenty-light size. The battery is composed, as is now well known, of a small Gramme continuous current-machine exciting a large alternating current, distributing machine. The large machine is divided into four circuits, capable of maintaining five lights each. In the present arrangement, three circuits only of the distributing machine are utilised, two maintaining four lights each, and one maintaining five lights. During the demonstration on Wednesday a lamp was temporarily added to the thirteen, and was kept burning in the engine-room, which i lighted admirably. The lights are arranged so as to be all switched from a switch-board placed on the ground floor. This arrangement of switching from one point is a new and important feature, and was shown in operation during the evening. The motive-power for driving the Gramme machines is obtained from a twelve horse-power "Otto" gas-engine, made by Messrs. Crossley Brothers, of Queen Victoria Street, London. This engine is a very important invention, taken with the electric light alone, and independently of its numerous other useful applications. It is made in various sizes to suit the many purposes for which it is required. In view of its special applicability in connection with the present subject, it may not be amiss if we point out some of its leading features and advantages. It, of course, has no boiler, and consequently all risk of a boiler explosion is removed, which permits of this engine being used where steam is inadmissible. As there is no risk of fire, the rate of insurance is not affected by the presence of an "Otto" gas-engine. There are no coals to get in or store, or ashes to remove. There is no smoke, consequently the neighbourhood is not disfigured by a high chimney with its cloud of smoke, and the owner is not annoyed by visits of the inspector of nuisances. The "Otto" gas-engine is always ready to start at a moment's notice on lighting a jet of gas and turning the fly-wheel, there being no delay till steam is raised as in the case of a steam-engine. By dispensing with the boiler, the boiler attendant's wages are saved; in fact, this gas-engine offers all the advantages of a steam-engine without any of the accompanying disadvantages of having a steam boiler on the premises. Economically speaking, the gas-engine is cheaper to work than a steam-engine, especially when the work is intermittent; it is, therefore, no matter for surprise that the "Otto" gas engine is largely replacing steam-engines where a supply of gas is available. We are informed that this engine is taking the place of steam at the rate of twenty-five engines a week, a fact which should go a long way to reassure holders of gas stock.

Returning to the Gramme machines, we may observe that they are driven directly through pulleys fixed on the shaft of the engine, the small one, or excitor, running at a speed of 612 revolutions, and the large one, or distributor, a speed of 688 revolutions per minute. They are, together with the gas-engine, placed in a room in the basement of the building. The whole mechanical and electric plant which has been fitted up under the supervision of Mr. J. A. Berly, C.E. (the engineer to the Société Générale d'Electricité), are erected in the most substantial manner. From an experiment made by Mr. Berly and Mr. Wilson, C.E. (the London representative of Messrs. Crossley Bros.), twenty lights were maintained by the gas-engine, and there is no doubt that a larger number could be maintained after the plant has been in operation for a short time, as the stiffness with which all new machines work will gradually disappear and the producing qualities of the Gramme machines will gradually improve. This has invariably proved to be the case with these machines on the Thames Embankment and elsewhere. We have mentioned as one special feature of this most recent application of the Jablochkoff system, the plan of switching from a central point. Another consists in the fact that this is the first time, in this country as well as in France, that so large a number of Jablochkoff lights have been worked from a gas-engine. Messrs. Samuel Brothers deserve every credit for the enterprising spirit they have shown in adopting for their establishment this mode of illumination, which gave every satisfaction upon the occasion of its inauguration.

It is gratifying to note the advance of electric lighting, exemplified by the Jablochkoff system. Taking the great public example—the Thames Embankment—we have there fifty lights including the ten on Waterloo Bridge. At four private establishments, in London there are fifty lights more, whilst the Marquis of Salisbury has six lights at his seat at Hatfield. In Birmingham there are forty lights at Aston Lower Ground. In Dublin a private firm are using six, whilst a Spanish vessel, the *Cosmos*, plying on the river Plate was recently fitted here with eight lights. Including the thirteen lights at Messrs. Samuel Brothers, this gives a total of 173 lights at present in use in Great Britain. The applications of the system in foreign countries are not, of course, included in our present consideration. The Société Générale are to be congratulated upon the steady—although not rapid—advance they are making in the practice of electric lighting.

OUR TRADE SUMMARY.

IN the early and unconfirmed period of the revival fears were entertained and generally expressed that the new prosperity might be checked by a premature rise in prices. That rise has been steadily going on for some time and still continues, whilst both for crude iron and for most of the articles manufactured from it there is a steadily increasing demand. There have been considerable fluctuations in the price of Glasgow warrants during the week, occasioned, as in the previous one, by rumours of prospective inquiries from America and the Continent, which do not, however, yet appear to have got beyond rumour, although the effect has been to raise the special brands to 90s. a ton, a total advance of 100 per cent. The makers of manufactured iron are reported full of orders, and common bars have risen this week to £9 10s.; ship and boiler plates and iron rods have similarly advanced, and there is still considerable difficulty in getting prompt orders executed. The Clyde shipbuilders have now on the stocks 146 vessels with a tonnage of over 200,000, although here the increasing value of material has somewhat checked orders. The other branches of the iron trade in the district appear to be doing moderately well. The state of the Middlesborough market seems to be even more satisfactory; and our correspondent aptly illustrates the condition of matters in the north when he contrasts a rise of 5s. a ton from week to week with the state of matters existing only a few short months ago. Pure, mottled, and white qualities are greatly in demand and very scarce. Another mine has been opened, and the North-Eastern Railway Company are making arrangements to meet the increasing needs of the mineral traffic. There is as much activity as ever in the finished trade, although the sudden rise in pig proves somewhat embarrassing to those manufacturers who have not bought as against their contracts. Both in this department and in shipbuilding, operations have been hampered by the precipitancy of the workmen in claiming an advance. Improvement proceeds without check in the rich mineral districts of the north-west; and prices now exceed the comparatively high figures of the past. £6 per ton is said to be obtainable for the best hematite, and transactions at £5 10s. have been actually noted; and while, in other cases, makers have refused those terms, on account of the extent to which they are sold forward, the excess of demand and increase of prices are actually beginning to engender doubts of the permanency of the revival, on the theory, we suppose, that things are too good to last. The sales already made for spring and summer are very large. The shipbuilding, engineering and other and minor iron industries of the district, are in an equally thriving condition, and everywhere there is a great increase of output, and preparations for extension of works. In the Manchester market prices of pig also manifest the same upward tendency, although the demand for local consumption has not shown itself yet to any great extent. Prices are now about 70s. per ton for both foundry and forge qualities, and makers are unwilling to do much business even on these terms. As indicated above, the local founders, engineers and machinists are still far from busy, although a more hopeful feeling obtains amongst them. The trade of all kinds in the more limited districts of Derbyshire, Lincolnshire, Notts and Staffordshire continues in a thriving condition, and additional furnaces are going into blast. From South and West Yorkshire there are equally favourable accounts. In the Sheffield district the principal feature to note is the rapid and general advance in prices for the best iron. Ironmakers are unwilling to accept orders forward at existing rates, and advices from the Continent indicate enlarged trade even before the spring months and requirements. In the Leeds district makers are getting rid at good prices of the stocks accumulated during the period of depression, but there is slackness in the locomotive and some other important branches. The special trades of Sheffield are busier, with fairly large orders from Australia and other quarters, and general activity is anticipated before very long. The local manufactures of which Birmingham is the centre also present a somewhat encouraging aspect, with better prospects than were visible a short time back. There is nothing satisfactory to report of the coal trade anywhere. With an an increased demand in one or two districts, there is no material change in prices.

THE MANUFACTURE OF CUTLERY.

IN a notice of some of the leading industries of Sheffield, which recently appeared in our pages* we promised some general particulars respecting the manufacture of cutlery, which we now proceed to place before our readers. In all ages there has existed a necessity for cutting instruments, those of rude nations consisting of shells, flints and sharp-edged stones, which, however, have found dexterous users. The ancient Britons used as knives the stone celts which are found in the barrows of our island. Iron was used at a very early period for this purpose, but brass, being more easily wrought, was more frequently used in the present connection. The date of the introduction of cutlery into Great Britain is uncertain, although from the Custom House entries it would appear that long before the time of Henry VIII. knives were imported. At an early period of Queen Elizabeth's reign, viz., in the year 1563, a restriction was put upon this import trade with a view to encourage home production. At that time London appears to have been the chief mart for the finer kinds of cutlery although a considerable trade was carried on at Sheffield. Salisbury, Woodstock, and Godalming, also, were centres of this manufacture. Stow tells us that one Richard Matthews, on Fleet Bridge, was the first Englishman who attained perfection in the manufacture of knives and their handles. In 1417, Henry V. granted the London Cutlers a charter of incorporation, and their Hall is still maintained. Long previously to this, however, Sheffield had become renowned for its cutlery, so that Chaucer, writing of the Whittler of Trompington observes, "A Shefeld thwytel bare he in his hose," the "thwytel" being a sheathed knife or whittle.

The incorporation of the cutlers within Hallamshire into the present Cutlers' Company did not take place until 1624, although special rules for the government of the craft were formed long previously. The functions of this important governing body are well known, as are also its annual festivals, which form occasions for brilliant social gatherings, and afford distinguished political personages and others opportunities of expressing their opinions on public events. The banquet is given by the Master Cutler upon his installation in office, and the sum of £105 is voted by the Company towards the expenses, which sum, however, is always considerably exceeded, the balance, we believe, being met by the Master Cutler. By way of contrast to the above amount, and as indicating the change which has taken place in the social habits of the men of Sheffield—but which change is by no means confined to the men of Sheffield—we may mention that the expenses of the Cutlers' Feast in 1749 were:—Rump of beef, 3s. 4d.; six fowls, 2s. 8d.; ham, 3s.; pies and puddings, 2s. 6d.; hares, 1s. 6d.; loin of veal, 1s. 10d.; bread, 1s.; butter, 2s.; roots, 4d.; ale and punch, £1 0s. 7d.; dressing, 4s.—total, £2 2s. 9d. Of this amount, £1 1s. was collected by the Company, the balance of £1 1s. 9d. being paid out of stock. But we have digressed somewhat, and must now quit the use of cutlery and resume our theme proper—its manufacture.

In the cutlery trades the sub-division of labour is very largely carried out. Not only is each department, such as forging, grinding, and the like, performed by separate workmen, but the man who forges or grinds one particular class of blades—pen-knife blades for instance—does not work at table-knife blades. Even the smaller and larger blades of pocket knives occupy different workmen, and these distinctions and sub-divisions of labour proceed throughout all the different branches of the cutlery trade. The "thwytel," or "whittle," to which we have already referred, appears to have been the first product of the Sheffield trade. It was a rough kind of spear or table-knife, having a wooden haft, and being used for all purposes. It was generally carried as a weapon, by persons whose rank did not entitle them to wear a sword. The first knife made to open and close was the jack-knife, and this formed the next development of that class of article the manufacture of which class, "spring cutlery," as it is termed, we will first describe. Here the steel ingot, which is already rolled or hammered to the required size, is first placed in the hands of the "forger" or blade maker. This hand works in a small room containing a hearth, a trough to hold water and another for the small and specially prepared coke for the fire. An anvil, weighing from two to four cwt., and other tools, complete the equipment of the forge. The forger buries the end of the bar of steel in his fire and then raises the metal to the required heat. This has to be done very carefully, for if over-heated the steel becomes burnt, that is, it is changed from steel, which is a carburet, into a sulphuret of iron, which is useless for cutlery purposes. Again, if not adequately heated, it is not sufficiently soft to take the intended shape.

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* *Vide* IRON, vol. xiv., page 674.

When duly heated, the end of the bar is fashioned on the anvil, with a few strokes by an expert hand, into a blade of the required shape, and is cut off the bar, which is again heated for the renewal of the process. The end of the blade, where it is attached to the handle, is called the "tang," and the next stage in the knife's history is the grinding of this part. The building in which the grinder works is commonly called a "wheel," and each separate shop in it is denominated a "hull." These "wheels" are amongst the most curious and characteristic of the manufacturing sights of Sheffield. The whole place is tinged with a peculiar brownish yellow hue, caused by the particles thrown off from the stones on which the blades are ground. These stones are driven at rapid speed, and at each of them sits a workman; the steel blade, which is dexterously held to the surface of the stone, sending off a continuous shower of sparks. In this way the tangs are ground, together with one side of the blades, preparatory to marking. The marker's shop is the counterpart of the forger's. He works with a coke fire on which a narrow iron tray, containing the blades to be marked, is placed. The fire is urged until the blades assume a dull red heat, called "warm red;" the blades then being sufficiently soft, the marker places half a dozen of them upon the anvil and stamps the manufacturer's name and corporate or distinguishing mark into the tang and in many instances on the side of the blade as well. The blades thus marked are returned to the forger for hardening and tempering. The hardening is effected by placing them again upon the fire in the iron tray, bringing them to a dull red heat and plunging them into cold water. This renders the blades hard and brittle, and they have now to be tempered. They are, therefore, first cleaned with fine sand and then placed once more over the fire on a steel tray, where they remain until they assume a straw colour, or bright blue tint, when they are removed and allowed to cool. All that the blades now require is to have an edge given to them, and for this purpose they are returned to the grinder's "hull," and are there ground. The blades are then passed to the cutler, accompanied by the other parts necessary to make up the complete knife. These parts consist of, first, the springs, which are made of steel, and which vary according to the number of blades. Then there are the outer and inner scales—the outer scale constituting the covering of the knife, and consisting of either pearl, ivory, horn, shell or wood. The inner scale is composed either of iron, brass, or german silver, and forms the chambers into which the blades fit. These parts, together with the "bolsters," rivets, &c., for fastening the whole together, are carried to the cutler's shop for manipulation. The knives having been put together and polished in part, are wrapped in paper and once more returned to the grinder to be polished. They are afterwards taken to the warehouse, where they are whetted or sharpened, cleaned, and packed for the market.

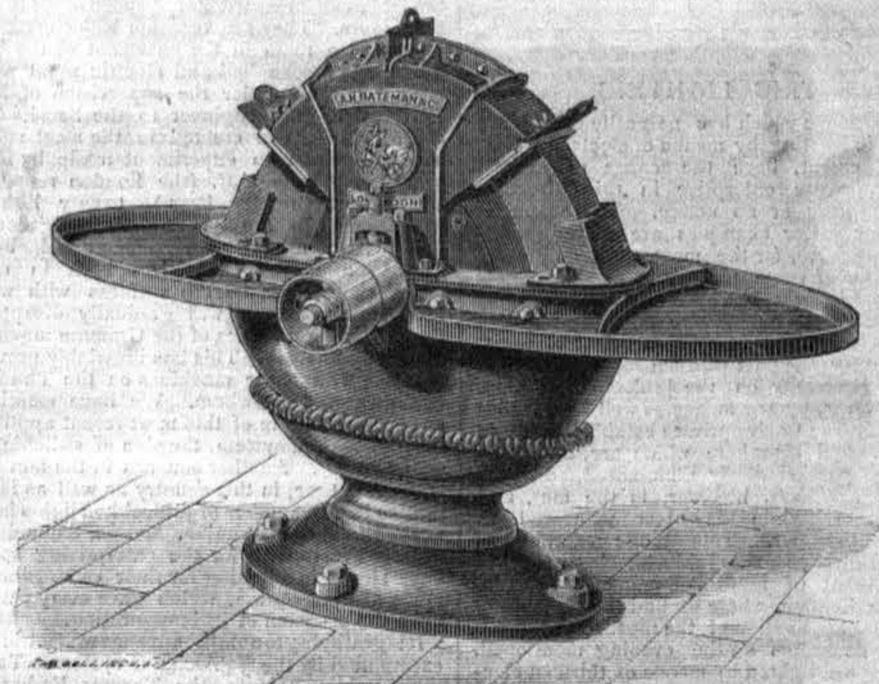
The manufacture of table-knives varies from that of spring or pocket-knives only in some of its details. As we have seen, the spring-knife forger works alone; the table-knife forger, however, employs a "striker" who uses a heavy hammer. The forger turns the steel about on the anvil, indicating with his own smaller hammer where the striker's blows are to fall, and also aiding in the work. The blade is first forged in the rough from the end of a thin bar of steel, and is then cut off and welded to a small piece of iron of which the bolster and tang are formed. The bolster is the raised part between the blade and the haft, and is formed between dies of the size and shape required. The tang is that part of a table-knife which fits into the handle. It is drawn out by a few rapid strokes of the hammer. The tang is made round and tapering for ivory and other solid hafts, and flat for hafts composed of thin scales requiring to be riveted like those of the spring knives. This constitutes the process of hand-forging by which all blades were formerly made. Some manufacturers, however, now forge common table-knife blades by machinery, making the bolster and tang of steel as well as the blade. In this case, as in hand forging, the end of a rod of steel is first heated, the blade roughly shaped under a steam hammer and afterwards cut off, with a small additional length for the bolster and tang. The bolster is shaped without reheating, but the steel is heated afresh for drawing out the flat tang. The blade is next reheated and "plated," or hammered out thin and broad. The blade and tang are afterwards "flyed," that is, they are successively forced into dies in which the edges are cut off, and they are reduced to the exact size and shape required. Still cheaper sorts of table knives are made by flying the blade and tang out of a cold sheet of steel at one operation, thus saving the processes of forging, tanging and plating, defects of appearance being overcome by ingenious devices in hafting. Sheffield manufacturers, however, prefer to employ the most intelligent hand labour in the production of best cutlery. They, however, freely use machinery for drilling, boring and other similar detail operations in which uniformity and exactness of make render its employment preferable to that of hand labour. After the forging has been completed, the blades undergo grinding, hardening and tempering, and are then passed to the cutler to be hafted, after which they find their way back to the grinder's room to be "buffed" or finished. Upon the processes of hardening and tempering the value of the finished article largely depends, and it is by careful attention to these points that the reputation of Sheffield cutlery has mainly been made and is sustained.

We pass by the manufacture of dessert cutlery, which is of a more elaborate and ornamental character, and proceed to notice that of razors and scissors. Few articles of cutlery vary in quality more than razors, and in no case is finish of workmanship so perceptibly valuable. Razors of the highest class are forged from the very best qualities of cast steel, and are made with the utmost finish and care in every stage of their progress through the manufactory. The bars from which they are formed are about half an inch wide, and no thicker than suffices for the back of the razor. The blade having been forged, the concave surfaces on the sides are formed on the rounded edge of the anvil. The rough blade is then cut off, and the tang is formed, either by drawing out the steel or welding on a piece of iron. After this the blade undergoes the processes of hardening and tempering, fitting in their handles, and finishing generally for the market. A curious point for solution in connection with the razor trade is whether the fashion of growing beards, which has of late years prevailed in this country, has in any way influenced the manufacture of these articles—that is, whether the trade has fallen off at all. On the other hand, the practice of shaving has of late years come somewhat into vogue abroad, and hence a question as to whether the export trade has been increased thereby. On these points Messrs. Joseph Rogers and Sons, of Sheffield, inform us that the razor trade has suffered a little during the last four years. They, however, attribute this to the general depression, particularly in the Indian trade, which is for cheap qualities, and to the depreciation in silver, which they consider has checked the demand rather than any beard movement. So far as regards the better and best grades of razors, a good uniform trade has been maintained—all things considered. With the common grades for India, and other foreign parts, a decided improvement has recently manifested itself in the trade. This hardly solves the question with which we started, as the beard movement dates far longer back than four years; but it is interesting to note that there is a fluctuation in these common necessaries of civilised life. Scissors vary very much in quality, and still more in shape, there being a great many varieties. In their manufacture each blade is forged with sufficient steel at the end to form the shank and bow. To shape the bow, a hole is punched through the metal, and it is worked into shape upon a mandril with a hammer. After having been rendered soft by re-heating, the shank is shaped and the bow more perfectly rounded with the file. The joint is also squared, and the hole bored and fitted for the rivet. The blades are next ground, and the bows and ornamental work smooth-filed. The separate blades are then screwed together, so as to form the complete scissors. They are then tried, and when it is seen that they work properly, they are unfastened and hardened and tempered, after which the whetting, polishing, and other finishing processes are performed, and they are packed ready for the market.

It will thus be seen that the manufacture of cutlery involves a large number of detail processes. There are, however, many others connected with the production of this class of goods to which we have made no reference here, having given particulars in the notice referred to at the commencement of the present article. These have reference more especially to the handles of pocket-knives, razors, and table cutlery, and respecting which we gave some facts at the time, and we may here mention that a large business is done in hafting in conjunction with the cutlery trade. Some of the largest cutlery makers buy the hafting materials and cut them up on their own premises, but the preparation of the handles also forms a separate and extensive trade. We, however, hope that the perusal of our remarks on this subject, past and present, may prove as interesting to our readers as was to us our visit to the leading cutlery works in Sheffield.

TOOL GRINDING MACHINE.

BY MESSRS. A. H. BATEMAN AND CO., OF GREENWICH.

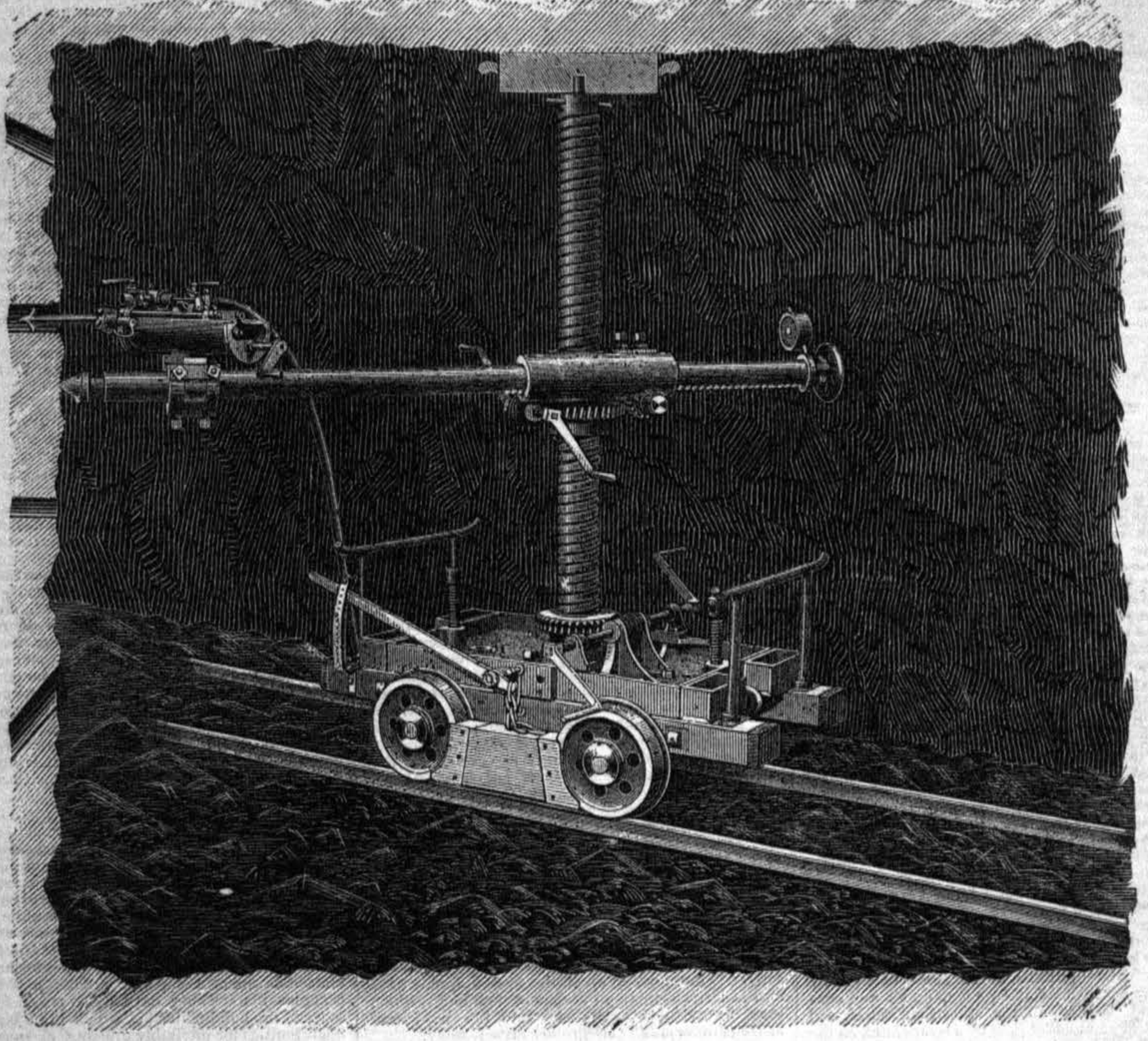

A.H.BATEMAN & C.

BATEMAN'S NEW TOOL GRINDER.

IN connection with the Smithfield Club Cattle Show, we briefly noticed some novelties lately brought out by Messrs. A. H. Bateman and Co., of East Greenwich, and we now give a description of the newly-designed emery machine for grinding tools, shown in the annexed engraving, and which has been made for use of the Government establishments. The wheel, which is composed of a special tool-grinding mixture, is 36 inches in diameter, with a 20-inch hole, and 3 inches wide at the edge. It is slightly thicker in the centre, and the side plates are formed to suit, on a system which embodies an element of safety should the wheel happen to break, which one did by being accidentally dropped when out of the machine, and we are informed that it was replaced

ROCK DRILL CARRIAGE.

MANUFACTURED BY MR. JAMES Mc'CULLOCH, MANCHESTER.



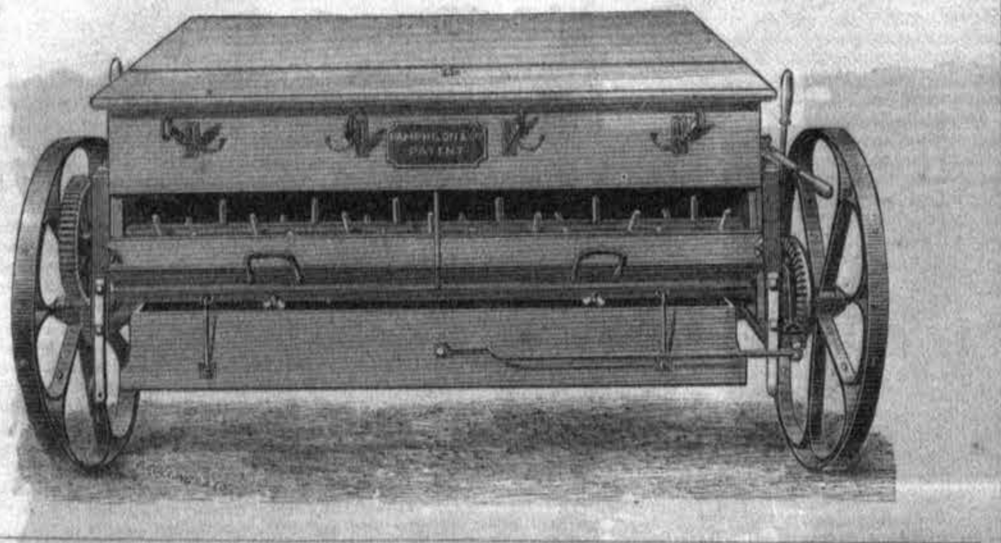
and used in the fractured condition for several months with perfect safety. The shaft is 1⅛ inches diameter and runs in long bearings of "metallined" gun-metal. The inside ends are enlarged into globes, which are held in place by cast-iron cups pressed on to the tops by set screws in the plummer-block caps, where oil-cups are usually inserted. The frame forms a trough for water—not that the wheel runs in water like a grindstone, but it is supplied with fine jets by a small centrifugal pump, for preventing the tools from losing their temper. Rests, as shown, are fitted on each side of the trough, so that tools may be ground in either direction of the wheel's rotation. The rests also facilitate grinding on the edge and on 2 inches of both sides; and slotted holes permit of their being brought nearer the centre as the wheel becomes worn. The spaces between the wheel and the sides of the trough are covered in by wrought-iron plates, to prevent tools of other articles falling in and so becoming a source of danger. This is still further provided against by the clearance at the edge of the trough being made less than at any other part, owing to the wheel and sweep of the trough not being concentric. To prevent splash, a fixed cast-iron hood is provided with movable hoods, one on each side and sliding under it, which can be brought down nearly to the rests, being counterweighted by plates extending into the trough. Three slides, fixed by set-screws, also help to prevent splashing. One end of the shaft is fitted with fast-and-loose pulleys, the latter metallined, and the other carries a pulley, which, by means of a belt, drives the small centrifugal pump before referred to and which is fixed on a bracket bolted to the foot of the trough. This draws water by a pipe attached to its centre, and delivers it by a vertical pipe branching out right and left. The ends are provided with universal joints, so that they can be turned in any direction; and two small holes are drilled, through which jets play upon any part of the wheel. The water flows from the rest on to the elliptical table bolted to the top of the trough, and runs back again through a hole drilled in the bottom near the curved rib which separates the ends or water portions from the sides, which are kept dry for holding tools. To make this grinder as complete as possible, gas-burners are fitted at its side both for giving light and preventing freezing.

ROCK-DRILL CARRIAGE.

ONE of the most useful class of machines in connection with tunnelling and mining operations is undoubtedly that of Rock Drills the varieties of which have greatly increased and multiplied during the last few years. But useful as these machines are, their usefulness is just in proportion to the effectual way in which they are carried and held up to their work. This point has been made a study by Mr. James McCulloch, of Higher Broughton, Manchester, and he has succeeded in producing the very efficient rock-drill carriage of which we give a perspective view in the accompanying engraving. It will be seen that this carriage consists of an ordinary trolley or truck, on which is mounted a bed-plate carrying a vertical tubular bar upon the outside of which a screw-thread is cut. This vertical bar is raised or lowered by means of a screwed nut the outer periphery of which is cut as a worm-wheel. With this worm-wheel is geared a worm fixed upon a horizontal shaft, which is operated by the crank handles outside of the frame of the truck. By this means the vertical bar can be tightened up against the roof as may be required, thus fixing the apparatus in a thoroughly solid position. Upon the vertical bar is a cross head, which supports a horizontal tubular rack bar. This part of the apparatus is raised and lowered by means of another screw nut, whose exterior periphery forms a worm wheel, and which is geared with a worm fixed on a shaft supported in bearings on the cross head. The rack bar is made to travel in a horizontal direction by a toothed pinion, which engages with the teeth on the underside of the bar, and is operated by a crank handle at the side of cross head. The horizontal bar is moved in a circular direction by the means of the cross head. This rack bar is tubular, and encloses a shaft screwed at one end, its screwed part working into a pivot for adjusting the bar when in a working position. At the outer end of the shaft there is a self-acting weight, which acts upon the pivot when required. By means of this arrangement the horizontal bar is kept in a constant rigid position while the drill is at work, and at the same time it does not alter the position of the drill from the hole just started. The drilling machine is mounted upon the horizontal bar, and, as will be seen, may be adjusted to any required position or angle without moving the truck on which the apparatus is mounted. We are informed that in practice it is found that one man can adjust the machine in any position, and put it into operation with ease and promptitude, so that the drill, owing to the absence of delays, gets through more work and costs less for labour. It is well adapted to exceptionally rough work, and can be turned to any angle and adjusted at once to the height or width of heading without moving the carriage from the position taken up at the beginning of the operation. It will be seen that a firm foundation is provided for the drill, and that with it holes can be bored in every conceivable position, so that in blasting the utmost effect can be produced with a less number of holes, and at a considerable saving in explosives. The carriage is easily run back during blasting, and quickly returned to the working face. Although possessing great strength and rigidity, the carriage is easily taken apart, and it is found to involve but little cost or trouble to keep in repair. In a word, the value of this carriage has been well proved in several mines and tunnels, and justifies us in complimenting Mr. M'Culloch upon this latest outcome of his long practical experience in this class of apparatus.

MANURE DISTRIBUTOR.

BY MESSRS. PAMPHILON AND CO., WHITTLESFORD.



PAMPHILON'S MANURE DISTRIBUTOR.

ADDITIONAL interest is given to artificial manure distributors at the present time, from the fact that they are being largely used for gravelling the streets in frosty weather, performing that operation much more effectively and expeditiously than could ever be expected from manual labour. The distributor of Messrs. Pamphilon and Co., Whittlesford, which was shown in action as far as possible, at Smithfield Club Show, is now being tested in this capacity by the Salford Corporation. The annexed engraving shows a back view of this appliance as modified for its new work, the distinctive feature being the absence of cups and rollers. It is constructed almost entirely of timber, so that there is no liability to corrosion, and consists of an upper and a lower box. The upper box is divided into two parts, the higher acting as a reservoir for holding the gravel or manure, and feeding the lower portion as required. The lower portion contains the stirrer, consisting of a shaft set with pins, as shown in the engraving, and made to revolve by spur gear from one of the land wheels. This shaft is thrown in and out of gear by a lever clutch shown on the left, the driver taking his seat on the cover at the front side. The bottom of this upper box is fitted with a slide, set by the bars which are seen projecting, so as to regulate the delivery; and every eighth of an inch that this slide is withdrawn increases the dressing by one-hundredweight to the acre. The lower or distributing box is suspended from the upper by hanger links, and is made to oscillate laterally by bevel wheel and pinion, crank and connecting rod, worked off the other land wheel, and also thrown in and out of gear by a lever clutch on the right. Flappers are hung loosely at the bottom for throwing the stuff right and left. For turnips or mangolds a box with serrated bottom and apertures is attached for sowing the manure in drills. The horizontal lever shown on the right is for occasionally moving a stirrer, when nitrate of soda or other substance liable to cake together is employed. When soot is used, the cover serves, with some additional boards, to increase the capacity of the hopper. This appliance, which will distribute all kinds of artificial manure, carried off the only prize at the late Cowbridge Show.

The farm-yard manure-spreader is made entirely of wrought iron, no cast iron being used on account of liability to break during frost. It is attached to a hook in the centre of an ordinary cart-axle; and is fed by a man standing on the apparatus and raking the manure in from the cart. One of the land-wheels is geared to rollers, over which passes a web armed with slats and spikes for delivering the manure, while the other land-wheel drives an agitator, or shaft set with knives arranged helically, for affording a regular dressing. A lever-clutch throws the feed-web in and out of gear. It is claimed that, by the use of this machine, which is highly approved of by agriculturists, labour is saved, as there is no heaping; time is saved, as the hands usually employed to spread can be put to other work; and manure is saved, as it is all turned to account in the ground.

CHANGES OF LEVEL.—The east coast of Hudson's Bay is reported to be undergoing very considerable changes in its level. Since the posts of the Hudson's Bay Company were established at the mouths of the various rivers, there has been an increasing difficulty in approaching them with large craft; and this elevation is estimated to amount to between 5 feet and 10 feet within the last hundred years. The same changes have been observed on the west coast of the bay, at the mouth of the Nelson and Hayes rivers, near which is an island called Mile Lands, now several feet above high water, which, within the memory of man, was always submerged at flood tide.

OCCASIONAL NOTES.

SCOTCH DIAMONDS.

MR. MACTEAR perseveres, in the face of Mr. Maskelyne's report, in insisting upon the origin of his crystals from carbon—it is to be observed that he does not term them diamonds; and he adduces testimony to their extreme hardness from jewellers and diamond merchants who have employed them in gem polishing and engraving. Another Scotchman, a Mr. Baxter, of Dundee, claims to have performed the same feat as his countryman, Mr. Mactear. The occasion has also been laid hold of by a Parisian to proclaim the merits of certain very successful imitations of the diamond by means of "paste," in which he is interested; and *apropos* to the whole case, the *Scientific American* quotes a most extraordinary theory of the formation of the real gem. According to our Transatlantic contemporary, a Dr. W. F. Fletcher had the misfortune of losing a frog belonging to him out of what in the paragraph is called his "frogarium," and froggy was ultimately found behind the stove, dead and dried up. The doctor, we are told, dissected it, and found its lungs clogged by thousands of black crystals with regular facets presenting the same angle as those of the diamond. This remarkable discovery suggested the brilliant theory we have alluded to, that "in the ages gone by the huge reptiles of the antediluvian period, dying under circumstances similar to those under which the frog did, may have formed large crystals of carbon in their lungs, which were afterwards transformed into the hard and lustrous diamond." Heigh-ho! says Rowley.

THE NEW METROPOLITAN RECREATION GROUNDS.

The three recent territorial acquisitions of the people of London—Epping Forest, Hampstead Heath, and Burnham Beeches—are in a different category from ordinary parks. It is therefore to be regretted that the Corporation has thought fit to entrust the care of the most important to a landscape gardener, instead of to the distinguished naturalist who was a candidate for the appointment. It is essential that all three should be kept, as much as possible, in a state of nature, and as little of the garden or park element as possible introduced. Hampstead Heath already, it is said, shows signs of over-care, in the partial drying-up of the great bog which was noted as the habitat of rare marsh plants in the time of Queen Elizabeth, although most of them are now extinct from natural and other causes. A Field Club has been established in Essex, which will devote special attention to the fauna, flora, geology and antiquities of Epping Forest, and which will take a general oversight of the tract, with the view of checking the extermination of scarce plants and animals, without, of course, interfering with the pursuits of the genuine naturalist.

SCARCITY OF WORKMEN IN THE IRON TRADES.

When referring to the exodus of skilled workmen from England, we have taken occasion to notice the possible injury the country might suffer, when business revived, by the loss of so many able and enterprising mechanics. It has also been pointed out in these columns that the desertion of the iron and coal industries for agriculture is a special danger in America. This has already been experienced in England; for, concurrently with the cessation of the extreme depression in the North, a great difficulty was found in getting good puddlers and other iron-workers, many having emigrated, and others, having obtained employment at more healthy and pleasant occupations, declined to go back to perhaps the most slavish and exhausting of all labour, coal-mining itself not excepted. A good many men are, however, employed in various quarters in relief works under the Poor Law Administrators, and from them probably a certain proportion of the deficiency will be supplied; but the want of some of the most energetic workers in all branches, who are now settled on the land in the western and southern hemispheres will certainly be felt at a later period if the industrial improvement continues to extend as it is likely to do.

THE PREVENTIBLE DANGERS OF THE SEA.

It is curious to note how some classes of accidents touching life or limb come home more than others to the imaginations and sympathies of mankind. The wholesale, but mercifully sudden, destruction of human life, by the upsetting of the Tay Bridge, is a universal, theme, while hundreds of seamen are perishing as helplessly in mid-ocean by the wreck of grain-carrying steamers, heavily laden, and heavily insured, with nobody troubling his head about it, the casualties in most cases arising solely from improper stowage by placing the grain in bulk instead of in bag, only, as it has too often proved, insufficiently protected by loose partition boards which fail to prevent the shifting of the cargo and the consequent foundering of the ship. Between two and three hundred valuable lives were thus sacrificed in the spring of last year, and already several large steamers which sailed in the end of the year from New York, grain-laden, have been missing so long that they must be given up as lost, raising the sacrifice of life by 100 to 150 additional. There are other avoidable perils of the sea besides those depending on shipping grain in bulk. Careless stowage of explosives is one, and the loss of many a good ship is probably due to that cause. The other day, also, a fire which broke out on board a steamer in mid-ocean was traced to the spontaneous combustion set up in adulterated silk goods, in which a subsequent chemical examination showed there were for every part of silk fibre two and a half parts of oils, organic and earthy matters, and three-quarters of oxide of iron, introduced to give weight and body to the silk. In addition to such sources of disaster, which, however blameworthy, are in some sense accidental, there remains, we fear, to be added the crime of wilfully sinking vessels and their crews for the sake of the insurance money. For the credit of human nature it is to be hoped that they are unfrequent, though of their occasional occurrence there cannot be any doubt, and even now the Board of Trade is engaged in investigating the cause of the foundering, in the end of last year, of a coal vessel under extremely suspicious circumstances.

BURGLARIES AND BURGLARS.

The frequency and completeness of recent burglaries and the difficulty the police evidently experience in getting at the offenders, appear to be owing, in a considerable degree, either to the adoption of burglary by a higher class of practitioner, or to his hiding himself among the middle class in order to pursue his nefarious calling more safely. Formerly Mr. William Sykes dwelt with other thieves, among whom he indeed bore himself as one of a superior grade; now he either occupies his working days as a member of one or other of the building trades, which gives him special opportunities for profitably utilising his overtime, or he poses as a respectable tradesman like Peace. On Thursday, last week, the Newcastle magistrates sat five hours investigating six burglaries, one case of sacrilege, two of housebreaking, one of shopbreaking, and one of larceny, that had been brought home to a man of the name of Hutchinson, a picture-frame maker in a respectable part of the town, whose house, like that of Peace, was found well furnished and filled with the produce of his robberies, which had been most audacious, creating quite a terror in the district. In London burglaries have for a considerable period been unusually numerous, housebreakers exceptionally violent when interfered with, and the police so frequently thrown out, both as regards prevention and apprehension, that it has been proposed to institute by private subscription a police reward fund, from which to give a gratuity to any police-constable who may apprehend a burglar in intention or fact. The causes noticed in the outset make the action of the police much more difficult, but it is well that householders should be reminded how much lies in their own power in the way of prevention by carefully looking to their bolts and bars, and taking advantage of the many devices in the direction of door chains and window catches which are now manufactured, and can be procured with little trouble.

THE CONDITIONS OF A MIRACLE.

The *Sheffield Telegraph* tells a good, and, probably, an original and authentic story, in connection with the sad disaster on the Tay. Several of the Scotch preachers, following the example of the ancient Pharisees in the case of the Tower of Siloam, have discovered in the appalling casualty a judgment of Heaven against Sunday trains. A correspondent of the *Telegraph*, hearing this view supported in a Dundee hotel, over the toddy, ventured with becoming diffidence to inquire why a particular Sunday evening should have been selected from among many. He was, however, promptly suppressed by one of the speakers. "Why?" growled he, "because on ither Sundays there was na wind aneuch!" According to explanations that have been given to the Chairman of the Dundee Harbour

Trustees, the difficulty of blowing over the reconstructed bridge will be largely increased. It is proposed in the renewed structure to rebuild the fallen piers of brick up to the height of the underside of the girders which were standing on each side; the spans are to be bowstring girders; and all the piers are to be stayed by malleable iron stays, fixed to iron piles, also of malleable iron, on each side of the bridge.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

THE INSTITUTION OF CIVIL ENGINEERS.

THE annual general meeting of this institution was held on the 23rd of December, being the Tuesday previous to Christmas Eve, as fixed by the bye-laws, Mr. Bateman, F.R.S., the president, occupying the chair.

In the report of the council it was stated that there was no more important subject for the consideration of the members, than the question whether the objects of the society had been adequately fulfilled, and, if not, then in what they could hereafter be more properly carried out. A succinct account was first given of the periodical meetings for the reading of papers and for the discussion of engineering topics, leading to a review of the publications of the institution, which for the past five years had comprised four volumes of "Minutes of Proceedings" annually. These volumes embraced original communications other than those read at the meetings, and also abstracts of papers, either addressed to similar bodies abroad, or printed in foreign scientific or technical periodicals. During the past session these volumes—issued respectively in the months of March, May, July, and September—had together contained 1704 pages. The minutes of proceedings proper, including the papers read at the meetings, reports of the discussions upon them, and written remarks, embraced 885 pages, the other selected papers occupied 343 pages, the obituary notices of deceased members 80 pages, and the abstracts of memoirs contributed to foreign societies and periodicals 396 pages. Every member, whether belonging to or only attached to the Institution, and wherever resident, received post free a copy of each volume as published. The advancement of scientific knowledge, more especially in its application to engineering, was, without doubt, materially promoted by the meetings, which afforded opportunities for the interchange of opinion among the best authorities on the topics brought forward; and the complete and rapid circulation given to the records of such meetings, supplemented as it now was by the additions described, furnished, perhaps, the most efficient plan that could be devised for the collection of information on all those many sciences upon which the successful practice of engineering depended, and for its dissemination to the many members resident in distant countries, where access to current engineering literature was difficult. The members were again urged to contribute the particulars of the mode of execution, the details of construction, and the cost of works at home, as well as to furnish short notes of useful facts and deductions acquired in the course of practice and observation. The next means that might be pointed to for promoting the objects of the institution was the library. Tracing its gradual progress, it was remarked that at present the collection contained 15,500 separate volumes, besides about 420 volumes of pamphlets. The members were reminded that the advanced position of this unrivalled collection of technical literature could only be preserved unimpared by suggesting the titles of important professional treatises not already in the library, and particularly by presenting copies of their own works and reports as published or printed. An account of the operations and condition of the institution during the past twelve months was then rendered. From this it appeared that there had been twenty-four ordinary meetings, at which sixteen papers were read and discussed, the authors of eight of these receiving Telford premiums for their communications. Twenty-five other papers were selected for publication, and the authors of four of these had been similarly rewarded. There had also been eight students' meetings, when as many papers were read, and Miller prizes had been bestowed upon four of these authors. During the year the council were engaged in effecting the separation of the professional from the non-professional associates, in accordance with the directions of the special general meeting of the 2nd of December, 1878. The qualifications and antecedents of 1670 associates had to be separately considered, of whom 1080 had been transferred to the group of associate members, leaving a residue of 590 in the original class. The elections had comprised one honorary member, 40 members, and 152 associate members, besides 23 associates not entitled to the privileges of corporate membership; while 68 associates had been transferred to the class of members. On the other hand, the deductions had been, by deaths, resignations and erasures, 71 members, associate members, and associates. There had been an addition in the twelve months of 1 honorary member, 79 members, and 65 associate members or associates, representing a total increase of 145. The gross numbers on the 30th of November last were: 17 honorary members, 1140 members, 1221 associate members, and 582 associates, making a total of 2960, irrespective of the students. This aggregate was more than double that it was twelve years ago. The student class now numbered 584, of whom 150 were admitted last session, when 42 students were elected associate members, and 24 ceased to remain on the list, so that the net increase had been 84.

The statement of accounts showed that the receipts, grouped under three heads, were:—From annual subscriptions and from dividends on Institution investments £10,960 11s. 9d., from admission fees and life compositions £2837 12s. 6d., and from trust funds £431 13s. 5d., together £14,229 17s. 8d. On the other hand the disbursements, similarly distributed, were — for ordinary expenditure £9826 10s. 7d. (including £4568 19s. 3d. on account of "Minutes of Proceedings), for Institution investments £4093 1s. 2d., and for trusts £530 18s. 9d., making a totol of £14,450 10s. 6d. The difference between the two sides of the account was met by the banker's balance being less by £220 12s. 10d. than it was twelve months ago. The accumulated property of the Institution now amounted to £31094 1s. 8d., the interest on which constituted rather more than one-tenth of the annual income. The nominal or par value of the Trust Funds, held for the purpose of awarding premiums, was £14,642 13s. 10d., the whole of which stood in Government securities.

In conclusion, the belief was expressed that, both in its organisation and its method of procedure, the Institution of Civil Engineers was distinctly and definitely dedicated to the promotion of science, that its present prosperous condition might be taken as a convincing proof of the high esteem in which it was held, and that a confident hope might therefore be entertained, that its practical and useful character would be as fully and as completely maintained in the future as in the years gone by.

The report having been adopted, the premiums and prizes awarded at the close of last session were presented by the President, to whom the thanks of the meeting were unanimously voted, the services of the Vice-presidents and Council, and of the Auditors, being similarly acknowledged.

AT the first ordinary meeting after the Christmas recess, held on Tuesday, the 13th of January, the new President, Mr. W. H. Barlow, F.R.S., delivered an address, in which it was stated that, his professional career having commenced in 1828, the same year as that in which the Institution had received its Royal charter, he proposed to draw attention to the great changes and progress in engineering which had arisen since that time. Undeniably, the influences that had mainly operated on the well-being of this kingdom and on the world at large, were the improvements in the means of communication, by the application of steam to locomotion on land and on sea, and by the utilisation of some of the powers of electricity in the transmission of intelligence.

For some time previous to 1828, an improvement had been urgently demanded in the means of transport for goods and minerals. The canals were estimated in 1836 to exceed 3000 miles in length; but they were wholly inadequate to the wants of the commercial interests at that time. Much attention was bestowed on turnpike roads, many of the main lines having been brought to a high degree of excellence by Thomas Telford, the first President of the Institution. Tramways, which existed long before canals and in considerable numbers in the mineral districts, were mostly of cast-iron, and belonged to private owners, few being applied to the general purposes of commerce. There were also some railways, distinguished from tramways, as their name implied, by being formed of rails instead of tram-plates; among which was the well-known Stockton and Darlington Railway. The application of steam in locomotive engines was in an early experimental stage; and the labours of George Stephenson, in connection with the Liverpool and Manchester Railway, formed the starting-point of that great railway system which had spread its network and its ramifications in many parts of the world. The system thus inaugurated in 1830 was estimated, in 1875, to have reached 160,000 miles in length, the capital invested in their construction having been 3200 millions sterling. Since then there has been considerable extensions; and when it was remembered that China has at present no railways, that Japan was only beginning to construct them, that Africa, with a population of between 350 and 400 millions, was almost without railways, as well as a large part of South America and Central Asia, and that the British Colonies were still badly provided, it must be obvious that the railway system would continue to increase. It had been ascertained that the traffic growth on all the lines in the United Kingdom, over a period of thirty-two years, had averaged more than £100 per mile per annum. To meet the exigencies of this increase, a reconstruction of the permanent way, engines and carriages has been necessary, as well as extensive additions to stations. While these improvements had added much to the comfort of railway travelling, a complete system of block-signalling, the employment of continuous brakes and the interlocking of points and signals had greatly increased the safety, notwithstanding the higher speed and the greater number of trains. The recent most lamentable and unprecedented accident at the Tay Bridge was at present the subject of a searching investigation, which it might be hoped would reveal the probable cause or causes that had contributed to such distressing results, and thus afford information of the greatest value for future guidance.

The limited number of steam vessels existing in 1828 were chiefly employed in river and coasting traffic. At that time all ships, including ships of war, were of timber. Ocean steam navigation had not been attempted, the starting-point of which might be said to have been the almost simultaneous voyages of the *Sirius* and the *Great Western*, in 1838. Its commercial success and extent to which it had been carried were owing to improvements which involved a greater range of scientific knowledge than the construction of railways, and were due to deep thought and unremitting perseverance. By improvements in the marine-engine, the consumption of fuel had been largely reduced; the screw propeller had taken the place of the paddle-wheel, by which greater advantages in propulsion had been obtained; and the substitution of iron and steel for timber in the construction of ships, combined with a better knowledge of their forms and lines (the latter owing mainly to the valuable researches of the late William Froude), had enabled vessels to be made of much greater strength and carrying capacity. The extension of ocean navigation had rendered necessary a great increase in dock and harbour works, several of which were alluded to; but the number of wrecks that occurred annually within British waters, seemed to show that more harbours of refuge were required on the coast of the United Kingdom, while there was evidence that the development of steam navigation was impeded by an insufficiency of harbours. This was especially observable in regard to the communication between England and France. It was satisfactory to learn that the French Government was about to improve the harbours on the coast of France, and it was hoped that this would be followed by correspoeding action on the part of the English Government.

The introduction of electricity for the purposes of telegraphy, and more recently for the production of light, and lastly, for the transmission of power, was a matter of special interest, as being one in which the labours of the philosopher, and the discoveries originating in his laboratory, were made directly serviceable "for the use and convenience of man." As in many other discoveries and new applications of science, the form which the telegraph ultimately received at the hands of Sir Charles Wheatstone and Sir William Fothergill Cooke, and its use to signalling on the Blackwall Railway in 1838, had been preceded by various suggestions showing the conception of the idea. Sir Francis Ronalds made a telegraph worked by frictional electricity, of which he published an account in 1823. A much nearer approach to the needle telegraph was an experiment by the late Professor Barlow (the father of the President), who used a galvanic battery, and deflected small compass needles placed in different parts along the conducting wire. By this experiment, which was recorded in the *Edinburgh Philosophical Journal* for 1825, Professor Barlow found that considerable loss of power arose with increase of length, and he was in consequence discouraged from proceeding further than determining some of the laws on which that decrease depended, and also the relative conductivities of different sizes of brass or copper wire. The large-quantity battery that had been employed in his experiments on electro-magnetism was used without any coil, and the wires were hung to the posts without any insulation. In 1875, the total length of wire in operation was estimated at 400,000 miles. Since then the Eastern Telegraph Company had extended its lines to the Cape of Good Hope; two new cables had been laid between France and America, and large extensions and duplications of land lines had been made. There were no means of tracing the traffic growth of telegraphy; but by the introduction of the duplex system and the automatic working, together with other ingenious contrivances, the traffic must have increased in a far greater proportion than the length of wire in operation. The diminution of power, arising from increase of length in the conducting wire, had been surmounted by relays of power applied at fixed stations. By employing this ingenious expedient on the Indo-European Telegraph, Calcutta had frequently been put in direct communication with London, a distance of 7000 miles. Another application of the telegraph, now commencing in this country, but already in considerable use in America, was the telephone, first publicly exhibited by Professor Bell at the Philadelphia Exhibition in 1876. The power of transmitting the sound of the human voice and its articulation, gave it a high scientific interest. Its value as a commercial instrument consisted in saving the time required to write, transmit, and re-write telegrams. The more recent electro-dynamic machines had placed lighting by electricity on a totally different footing to that on which it formerly stood, and left no doubt of its applicability to many important purposes. It was, in fact, already established in lighthouses, where its intensity and power were of the highest value, and there were many examples of its application in public buildings and large shops, in railway stations and open spaces, and for street lighting. Whether it could be divided, so as to become equally economical and convenient for domestic purposes had yet to be ascertained. The distinction between the intensity of light and its illuminating power ought not to be overlooked. The intensity of a light bore the same kind of relation to its illuminating power as the specific gravity of a substance did to its weight. The latest application of electricity, namely, for the transmission of mechanical energy, was suggested by Dr. C. William Siemens, who had ascertained that, including all sources of loss, 50 per cent. of the original power could be realised at a distance of one mile, and that, with adequate provisions against heating, it would be no dearer to transmit electromotive power to a greater than to a smaller distance. Sir William Armstrong had availed himself of this force for working a circular saw placed at a distance of one mile from the waterfall which supplied the power. The deep-sea sounding-line on board the telegraph ship *Faraday* was hoisted by mechanical energy thus transmitted from the engine; and Dr. Werner Siemens had succeeded in obtaining locomotive power sufficient to convey thirty persons by similar means.

By the action of the City of London, and at a later period of the Metropolitan Board of Works, the condition of the metropolis has been greatly improved. But during the last fifty years the only additional public communications made across the Thames, within the active metropolitan area, were the Hungerford Suspension Bridge, since removed and replaced by the public footway in connection with the Charing Cross Railway Bridge, and the Lambeth Bridge and the Tower Subway, the two latter constructed by Mr. Peter W. Barlow. The extensive increase of traffic in the more commercial part of the metropolis, produced such great difficulties at London Bridge, that some other road communication to the eastward of that bridge could not much longer be delayed.

The employment of gas as a means of illumination, which was in its infancy in 1828, had increased in a remarkable degree. The capital invested in gasworks in the United Kingdom was £40,000,000, of which about £12,000,000 represented the capital of the London Gas Companies. At the end of 1878 the length of gas mains in the metropolis was 2500 miles, and there were about 58,000 public lamps for street lighting. In the same year the quantity of coal decarbonised was 1,715,000 tons, which produced nearly 17,500 million cubic feet of gas, besides residual products of the value of £745,000. The coal used was about four-tenths of a ton per annum per head of the population. Of the gross revenue 5 per cent. was derived from street lighting, 20 per cent. arose from the sale of residual products, and 75 per cent. from private consumers.

The application of wrought iron in the superstructure of engineering works having been touched upon, the President remarked that the improvements effected in the manufacture of steel assumed the character of new discoveries, which were tending to revolutionise the iron industries of the world. The inventions of Sir Henry Bessemer, followed by those of Dr. C. W. Siemens, and Mr. Martin, had led to this change. Besides the advantages which steel had over iron for rails, wheel tyres, and structural purposes, there was a general gain to the community arising from the smaller quantity of coal required for its production. Thus, to make a ton of iron about six tons of coal were necessary, but to make a ton of steel three tons of coal sufficed. The production of modern steel was a subject which the President had followed from its commencement with great interest. A Committee of Engineers, of which he was a member, had made an extended series of experiments on steel, and the subject had been referred by the Board of Trade to Sir John Hawkshaw, Colonel Yolland, and the President. This resulted in the adoption of a coefficient for steel of 6½ tons to the inch, that of iron being 5 tons: it being understood that for steel of high qualities the coefficient should be raised by agreement, due precautions being observed in the testing. Although enough was known about steel for ordinary structural purposes, there were properties belonging to that material which greatly needed further experimental inquiry. Untempered steel was very like good iron in two of its characteristics. First, it possessed nearly the same modulus of elasticity; and, secondly, the force required to extend it to the limit of its elasticity, or the force at which an appreciable permanent set first appeared, was about one-half that required to cause rupture. The superior strength of untempered steel over that of good wrought-iron was proportionate to the greater renge of its elastic action; and the ratio which this greater range of elastic action bore to that of iron varied with different qualities of steel. But the strength of steel might be greatly improved by tempering in oil, a process now much in use. Experiments were wanting to determine what change, if any, arose in the specific gravity of the metal when under strain within its limits of elastic action. Within certain limits the stretching, either of iron or of steel, beyond its original elastic limit increased the strength and the range of elastic action. The process of cold rolling was an example of this effect; and steel wire, drawn cold, exhibited remarkable strength,—that employed by Sir William Thomson in his deep-sea soundings having borne 149 tons to the inch. One of the most striking applications of the hydraulic press was that introduced by Sir Joseph Whitworth by which large ingots of molten metal were subjected to a pressure of six or seven tons per inch, and the ingot thus rendered perfectly solid and sound. At the same works, the hammer was dispensed with in large forgings of steel, the red-hot metal being pressed into the required form by the hydraulic press.

In the early days of the Institution, the laws which governed mechanical action and forces, and the strength of materials, were very imperfectly understood. In the interval the great advances in practice had been accompanied by a marked extension in an accurate knowledge of the physical sciences. Obviously it was most essential that engineers should be acquainted with the principles which lay at the foundation of mechanical science, and with the nature and properties of the materials employed in works. It was, therefore, satisfactory to find that many colleges now had special departments for imparting instruction in applied science, and the increasing area of scientific requirements rendered it desirable that a yet wider field should be given to that class of education. In conclusion, the President expressed indebtedness to those men, both within and without the profession, in foreign countries as well as in this, who by study and experimental research were continually adding to an exact knowledge of the great sources of power in Nature—that power, the direction of which to the use and convenience of man, constituted the fundamental element in the charter of the Institution of Civil Engineers.

THE INSTITUTION OF CIVIL ENGINEERS.—At the meeting of Tuesday, the 13th inst., Mr. W. H. Barlow, F.R.S., President, in the chair, it was announced that the Council had recently transferred Messrs. C. J. Albrecht, C. P. Barlow, B.A., J. F. Churchill, E. Jackson, C. Prime, J. S. Statter, R. G. Walton, and J. H. Whittle, to the class of members; and had admitted Messrs. G. H. Ainsley, H. Archibald, jun., A. G. Ashcroft, S. G. Batten, B. J. Beal, H. O. Bell-Irving, P. Benham, W. B. Bestic, F. T. Bird, R. Blunt, J. S. Boyer, G. C. H. Brown, C. Bownridge, L. Burnet, L. Burrell, O. R. H. Bury, A. D. Chapman, J. B. Chirnside, C. Cole, C. J. P. Coombs, T. Dunlop, G. H. Erskine, H. J. Eunson, W. A. Fenton, C. H. Hingeston, jun., F. G. Howard, I. Ishiguro, E. Ive, H. H. Lake, H. H. J. Lannon, H. Lawrence, G. H. Le Maistre, E. J. Lovegrove, W. H. McCannell, J. R. MacGachen, E. de Mérindol Malan, F. W. Maunsell, J. H. Medlicott, A. M. Moore, G. Morison, jun., K. W. Murray, C. J. O'Brien, T. W. Potter, T. T. Prentice, L. N. Richard, J. L. Rigden, W. F. Robertson, H. F. Rutter, R. J. Scott, F. M. Smith, J. C. Smith, A. W. Stansfield, E. P. Stephenson, J. H. Swainson, T. M. Teed, A. Timmins, R. E. von Lengerke, A. S. Vowell, G. K. Wasey, W. Watson, B.A., H. A. White, H. W. Wilkinson, C. St. M. Williams, G. P. Williams, R. R. Williams, and F. J. Wilson, as students; The monthly ballot resulted in the election of twenty-three candidates, of whom six were members, viz., Messrs. H. R. P. Carter, Deputy Chief Engineer of the Madras Railway; T. C. Fidler, Westminster; C. O'Neill, Wellington, N.Z.; T. Seyrig, Paris; H. Wallis, Supt. Grand Trunk Railway of Canada; and T. P. Watson, M.A., Chief Resident Engineer, Cape Government Railways, C.G.H.; fourteen were associate members, viz., Messrs. W. Crickmay, Caterham; G. Darbishire, Stud. Inst. C.E., Lincoln; A. Downie, Wolsingham, Durham; J. Francis, New River Company; L. P. P. Gallwey, District Engineer, P.W.D., Jamaica; G. A. Goodwin, Westminster; J. Horan, B.E., Rosslare Harbour Works, Wexford; H. G. McKinney, Melbourne; A. Primrose, Glasgow; H. De Quincey Sewell, St. Pancras; J. Standfield, Westminster; R. F. Ward, Coble Den Dock Works, North Shields; H. Woolcock, St. Bees; and B. Worthington, B.Sc., Stud. Inst., C.E., L. and N. W. Railway, Manchester; and three were associates, viz., Messrs. W. M. Cunningham, St. Petersburg; J. M. Livesey, Stourton Hall, Horncastle; and W. H. Topham, Melbourne.

CHEMICAL SOCIETY.

THE Chemical Society met on December 18th, Mr. Warren de la Rue, president, in the chair. A ballot for the election of Fellows was held, Dr. Massell and Mr. Neison being appointed scrutators. The following gentlemen were declared duly elected:—G. S. Allbright, J. R. Ashwell, T. Blackhouse, E. Buckney, J. Bemrose, W. J. F. Churchouse, M. Cochrane, E. J. Day, W. R. Dunstan, E. Francis. F. Hatton, J. Howard, J. J. Hummell, R. E. Holloway, W. R. Eaton Hodgkinson, T. S. Humpidge, E. Hughes, R. Jones, J. Knowles, A. Leibius, H. F. Morley, E. F. Mondy, H. Newton, J. Parette, J. W. Smith, I. Steiner, J. Snodgrass, A. Scott, G. Stallard; J. M. Wilson. The following certificates were read for the first time:—W. Nacnab, W. B. Roberts, G. Salet, T. Terrel.

The Secretary then read a paper "On the Specific Volume of Water of Crystallisation," by T. E. Thorpe and J. J. Watts. Some years ago, Playfair and Joule pointed out that the volumes of certain highly hydrated salts, as for example, sodium carbonate with ten molecules of water, also the alkaline arsenates and phosphates with twelve molecules, are equal to that of the water considered as ice which they respectively contain. Thus the molecules of the salt seem to exist in the interstitial spaces of the ice. This law does not hold good for salts less highly hydrated. Thus in borax, sodium pyrophosphate, and the normal aluminium sulphate, the volume seems to be made up of the water considered as ice, together with that of the base as existing in the free state. Schiff has shown that members of certain classes of hydrated salts have the same specific volume. Thus all the alums have a specific volume of 277 double sulphates, $M_2M''(SO_4)_2$ 207, and the vitriols $M''SO_4\ 7\ H_2O$ 146. The authors have determined the precise relation between the specific volumes of various sulphates of copper, magnesium, zinc, nickel, cobalt, iron, and manganese, and their respective degrees of hydration. They have incorporated in the present paper some results placed at their disposal by Dr. Playfair. Details of the preparation and analysis of the various hydrates employed are given. The specific gravity was determined by weighing in benzene at 15° C. The results are contained in the following table:—

Hydrate	0	1	2	3	4	5	6	7
$CuSO_4$	44·4	54·3	67·0	80·0	—	109·1	—	146·8
$MgSO_4$	44·8	57·6	67·0	—	—	112·4	130·8	146·8
$ZnSO_4$	45·6	54·7	66·6	—	—	113·7	130·2	144·6
$NiSO_4$	44·6	56·5	—	—	—	—	129·0	144·6
$CoSO_4$	44·7	55·2	70·9	—	97·4	114·6	130·1	146·0
$MnSO_4$	45·0	55·7	73·6	86·6	98·2	114·4	—	—
$FeSO_4$	44·5	56·2	67·7	—	100·5	—	—	146·7
Means	44·8	55·5	68·8	83·3	98·7	112·9	130·0	146·2

From these results it appears that in the case, at least of the so-called magnesian sulphates the volumes occupied by the several molecules of water varies with the degree of hydration. The first molecule, the "constitutional water" of Graham, occupies less bulk than any other. Its mean relative value is 10·7; the value of the second is 13·3; of the third, 14·5; of the fourth, 15·4; of the fifth (taking the mean of the most concordant numbers, $ZnSO_4CoSO_4$ and $MnSO_4$), 15·6; of the sixth, 15·7; of the seventh, 16·2. These results accord with the fact that the different molecules of water in a hydrated salt are held with various degrees of tenacity, as shown by the different intensities of heat needed to expel them, the amount of energy required standing in some relation to the degree of condensation in the combined molecule. The authors point out the importance of estimating the amounts of heat resulting from the combination of successive molecules of water with the different sulphates. Graham has already shown that more heat was evolved in the combination of the first molecule than in that of any of the remaining molecules; in other words, that the amount of heat developed is related to the degree of condensation of the combined molecules. As the foregoing numbers express the volumes in cubic centimetres of the equivalent of the salts in grammes, it appears that equivalent quantities of these different sulphates occupy respectively the same volume in space, or, in other words, the unit volume contains the same number of molecules of the different salts.

Professor McLeod then read a note on the formation of ozone during the slow oxidation of phosphorus. The active substance formed during the slow oxidation of phosphorus is probably either ozone or peroxide of hydrogen; the latter substance is readily destroyed by alkalies, a solution of chromic acid, or a solution of alkaline permanganate, whilst ozone is unaffected either by a solution of sodic carbonate or by chromic acid, and appears to be only slightly attacked by alkaline permanganate. Air in which phosphorus was slowly oxidizing was drawn through a U tube, 9½ inches long (filled with fragments of glass containing in succession sodic carbonate saturated with carbonic anhydride, a mixture of potassic dichromate and sulphuric acid and potassic permanganate previously saturated with carbonic anhydride), and then into a flask containing a solution of potassic iodide and starch; in all cases the latter solution became blue, both when the U tube was cold and when heated to 100°. Similar results were obtained when a U tube, 12½ inches long, was used packed with small pieces of pumice saturated with solution of sodic carbonate. The effect of heat on the gas was tried. The gas was aspirated through a narrow U tube, which was heated to 150° to 200°, beyond this U tube were placed first a weighed U tube packed with pumice and sulphuric acid, and secondly a flask with solution of potassic iodide and starch acidified with sulphuric acid. The U tube was weighed before and after each experiment, and the blue solution titrated with decinormal sodic thiosulphate. The gas was aspirated at the rate of 1 litre per hour. The following results were obtained:—

Gas aspirated	T of U tube.	Increase of sulphuric-acid tube.	Thiosulphate used.
4600 cc.	colt	0·0026 grm.	2·55 cc.
2760 ,,	100°	0·008 ,,	1·9 ,,
4600 ,,	150°	0·0026 ,,	3·2 ,,
2760 ,,	200°	0·0006 ,,	1·8 ,,

1 cc. of thiosulphate = 0·017 grm. of hydroxyl, which on decomposition forms 0·009 grm. of water, and as, at least, one half of the hydroxyl might be assumed to be decomposed, an increase of the sulphuric-acid tube in the lsst experiment should be 0·016 grm. instead of only 0·0006. Hydroxyl combines with acid. The gas from phosphorus was exposed to the action of strong sulphuric acid for four days without losing its activity. It is extremely improbable that ozone and hydroxyl are both formed, as these substances destroy each other. The author therefore concludes that the gas obtained during the slow oxidation of phosphorus possesses the properties of ozone, and not those of hydroxyl the only known peroxide of hydrogen.

Mr. Kingzett had listened to the paper with great interest, up to the present time no evidence had been put on record to prove that this gas from phosphorus contained ozone, and as he had shown that certain hydrocarbons which had been supposed to produce ozone really formed hydroxyl; he had assumed, in the absence of any evidence, that hydroxyl was formed in this case. After referring to the researches of Cornu, Mr. Kingzett said that he could confirm the observation of Professor McLeod that peroxide of hydrogen and ozone in the presence of an acid did not decompose each other.

After some remarks from the President, Professor McLeod briefly replied.

Mr. W. H. Perkin then read a paper on "The Analysis of Organic Bodies containing Nitrogen." Some years since he wished to determine the halogens as well as the carbon and hydrogen in bodies containing nitrogen. The substance was burnt in oxygen and the products of combustion passed over a weighed quantity of pure metallic silver. The difficulty arose as to how to get rid of the nitrous fumes; plumbic peroxide was first tried between the water-absorbing apparatus and potash bulbs. This succeeded as far as the carbon was concerned, but as nitrous fumes were absorbed by the sulphuric acid the hydrogen determinations were too high. Plumbic peroxide was then placed in the combustion-tube, but great difficulty was experienced in heating it to just the proper temperature. Potassic chromate was then tried and was found to succeed admirably; it absorbed the nitrous fumes completely, had no action on carbonic anhydride and could be heated without fear. The author therefore recommends the use of about 4 to 7 inches of potassic chromate in the combustion of all substances containing nitrogen, instead of freshly reduced copper, which is very hygroscopic and occludes hydrogen, or of silver which requires an inconveniently high temperature. The potassic chromate would be free from an excess of alkali, a trace of bichromate is not harmful, though bichromate does not work so well as chromate. The chromate should be roughly powdered or granulated by evaporating its solution to dryness with constant stirring; or, still better, coarsely-powdered pumice saturated with solution of chromate may be used. The chromate should be kept at a scarcely dull red heat. The author does not state how many times the chromate can be used. Chromate also absorbs sulphurous acid; it does not retain iodine vapour, but would be probably useful with substances containing chlorine or bromine. After a few remarks from Mr. Warington the Society adjourned to January 15th.

SOCIETY OF ENGINEERS.—We are informed that in consequence of the resignation of Mr. Graham Smith, as Secretary to the Society of Engineers, Mr. Alfred Elgar has been appointed to that office. Mr. Elgar was formerly assistant-secretary to the Institution of Naval Architects, and carries with him very strong recommendations for the office.

THE TOTAL ECLIPSE OF THE SUN.—On Tuesday last the observation party, under Professor Davidson, of the Coast Survey, and Professor Frisbie, of the Naval Observatory, witnessed the eclipse of the sun perfectly from the summit of the Saint Lucia Mountain in California, 6000 feet above the sea level. The first contact occurred within 1½ seconds of the computed time.

THE MARQUIS OF RIPON ON LOCAL SCIENTIFIC ASSOCIATIONS.—The Marquis of Ripon occupied the chair at a meeting of the Yorkshire Geological and Polytechnic Society on Wednesday, at Halifax, and in opening the proceedings referred to the past work and province of the society. Their work was of a twofold character. They had not only to collect facts and register observations, and even to discuss and examine into their bearings, but it was their special function to meet young men when they left the Universities or the higher schools or the Mechanics' Institutes, and help them to carry on the studies they had begun—to test, to guide, and to encourage them. The noble chairman also referred to the fissure found in the limestone rock in the Raygill quarries, near Skipton, in which remain of animals not now existing in this country, and some of them extinct, were found, and stated that he would be happy to contribute £10 towards the sum required for a thorough examination of this interesting fissure. Papers were afterwards read on several topics of interest.

IMPORTANCE OF TECHNICAL EDUCATION.—On Saturday evening, at Middlesborough, under the auspices of the Cleveland Iron Trade Foremen's Association, Mr. Dalton, of the firm of Messrs. Chilton and Dalton, engineers, &c., Middlesborough, read a clear and practically written paper on "The Development of Surfaces," with regard to boiler-making. The president of the Association, Mr. J. M. Owbridge, was in the chair. He stated that the subject was of much importance to Cleveland, if in no other way because of the economy or saving of material that arose from a clear knowledge of the science implied in projecting surfaces otherwise than by "rule of thumb." It was shocking to have to say that most of the workmen in boiler works in England had to go to a foreman for nearly every detail in the principles of the work. Few men, indeed, knew the elements that underlie the science. Men who do know the principles involved in such work commanded better wages. He was sorry he had met with so much indifference on the subject in the British workmen. On the Continent technical knowledge had been acquired by the artisan classes more than in England, and that fact constituted a real danger of being outstripped. The young apprentices there were far better up in the principles of technical work.

CHIMES AND CARILLONS.—A new carillon machine of the most efficient kind has been placed in the tower of St. Paul's Church, Bedford. The machine was constructed by Messrs. Gillett, Bland and Co., Steam Clock Factory and Church Bell Foundry, Croydon. It is made on the firm's improved patented system, of which they were the original introducers, and is similar in principle to those which they have erected at Worcester Cathedral, Christ Church Cathedral (Dublin), Llandaff Cathedral, Manchester, Bradford, and Rochdale Town Halls, and numerous parish churches throughout the country, and is altogether different from that made many years ago on the principles of the first patent at Boston Church, Lincolnshire, and abandoned in consequence of being too complicated. The carillons at St. Paul's are constructed to play 14 tunes on the eight ringing bells in the tower. The machine is erected on a cast-iron frame in the south-west corner of the ringing chamber and is contained in a glass case about 6 feet high, and about 2 feet 6 inches square. The distance between the machine and the bells is 32 feet. The hammer-heads which strike the bells vary in weight from 40 lb. in the case of the tenor to that of 16 lb. in that of the treble or lightest bell. Each bell is furnished with two hammers. These hammers with their cranks weigh about half a ton. The total weight of the machine is about 2 tons. The motive power which drives the machine is a cast-iron weight of 11 cwt. which has to be wound up every 24 hours to a height of 35 feet. It is carried by a steel wire rope ⅜-inch in diameter, capable of bearing a weight of 2 tons. Nearly 2 cwt. of wire was used in connecting the machine with the bells.

MEETINGS FOR THE WEEK.

MONDAY, JANUARY 19.

ROYAL ASIATIC SOCIETY.—4 p.m.

LONDON INSTITUTION.—5 p.m. Mr. J. E. H. Gordon on the Leyden jar.

INSTITUTION OF SURVEYORS.—8 p.m.

VICTORIA INSTITUTE.—8 p.m. The Rev. Dr. J. Fisher on the Organ of Mind.

ROYAL ACADEMY—8 p.m. M. Briton Riviere on Truth in Art in its Relation to Nature and our own Time.

TUESDAY, JANUARY 20.

ROYAL INSTITUTION.—3 p.m. Professor Schafer on the Physiology of Muscle.

INSTITUTION OF CIVIL ENGINEERS.—8 p.m. 1. Mr. L. I. Vernon Harcourt on Fixed and Movable Weirs. 2. Mr. R. B. Buckley on Movable Dams in Indian Weirs.

STATISTICAL SOCIETY.—7.45 p.m. Mr. G. Phillips Bevan on the Strikes of the Past Ten Years.

ROYAL COLONIAL INSTITUTE.—8 p.m. Mr. J. G. Bourinot on the Natural Development of Canada.

GRESHAM HALL.—Lecture 6 p.m. The Very Rev. Dean Cowie on Geometry.

WEDNESDAY, JANUARY 21.

METEORGLOGICAL SOCIETY.—7 p.m. Anniversary.

GRESHAM HALL. Lecture 6 p.m. The Very Rev. Dean Cowie on Geometry.

BRITISH ARCHÆOLOGICAL ASSOCIATION.—8 p.m. 1. Mr. W. H. Cope on Ancient Jade Implements. 2. Mr. W. de Grey-Birch on Ancient and Unpublished Documents.

SOCIETY OF ARTS.—8 p.m. Mr. Henry Carr on Domestic Poisons.

GUILD OF ST. LUKE.—7.30 p.m. Mr. G. W. Bloxam on Mesmerism.

GEOLOGICAL SOCIETY.—8 p.m. 1. Mr. J. W. Davis, On the Genus, *Pleuracanthus*, including the Genera *Orthacanthus*, *Diplodus* and *Xenacanthus*. 2. Mr. Bank Rutley, On the Schistose Volcanic Rocks on the West of Dartmoor, and the structure of the Brent Tor Volcano. 3. Mr. E. B. Poulton, On Mammalian Remains, and Tree Trunks in Quaternary Sands at Reading.

THURSDAY, JANUARY 22.

ROYAL INSTITUTION.—3 p.m. Mr. H. H. Statham on Modern Architecture since the Renaissance.

ROYAL SOCIETY CLUB.—6.30 p.m.

INVENTORS' INSTITUTE.—8.15 p.m.

GRESHAM HALL.—Lecture, 6 p.m. The Very Rev. Dean Cowie on Geometry.

LONDON INSTITUTION.—7 p.m. Mr. W. E. Ayrton on the 100,000th of a Second.

SOCIETY OF ANTIQUARIES.—8.30 p.m.

ROYAL SOCIETY.—8.30 p.m.

ROYAL ACADEMY.—8 p.m. Mr. E. M. Barry on Architecture Governed by Technical Principles.

SOCIETY OF ARTS.—8 p.m. Professor Perry on the Teaching of Physics.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—7 p.m. Mr. A. T. Walmisley on the Bridges of the Thames at London.

INSTITUTION OF MECHANICAL ENGINEERS.—3 p.m. Annual General Meeting (two days). Mr. B. C. Brown on Brown's Tramway Locomotive. M. Leon Francq—Reply on the Discussion of Fireless Locomotives. Mr. E. Hutchinson on Improvements in Machinery for Rolling Steel and Iron Plates. Mr. T. H. Riches—Is Automatic Action necessary or desirable in a Continuous Railway Brake? Mr. William Anderson on Chernoff's Papers on Steel. Mr. J. D. Larsen on Permanent Way for Tramways, with special reference to Mechanical Traction.

SOCIETY FOR ENCOURAGEMENT OF THE FINE ARTS.—8 p.m. First Conversazione at Suffolk Street Gallery.

FRIDAY, JANUARY 23.

CITY OF LONDON COLLEGE.—Dr. N. Heinemann, on Political Economy.

ROYAL INSTITUTION.—8 p.m., Weekly Meeting; 9 p.m., Dr. W. B. Carpenter, Sea and Land in Relation to Geological Time.

QUEKETT MICROSCOPICAL CLUB.—8 p.m.

GRESHAM HALL.—Lecture, 6 p.m., The Very Rev. Dean Cowie, on Geometry.

INSTITUTION OF MECHANICAL ENGINEERS.—Annual Meeting, 3 p.m. (For Papers and Discussions, see Thursday.)

SATURDAY, JANUARY 24.

ROYAL INSTITUTION.—3 p.m., Professor Rupert Jones, on Coal.

PHYSICAL SOCIETY.—3 p.m., Dr. O. J. Lodge, on the Theory of Professor Hughes's Induction Balance. 3. Mr. C. V. Boys, On a Liquid Voltaic Arc. 4. Mr. J. Faber, On a Talking Machine.

MINERALOGY AND MINING.

DEATHS FROM COLLIERY EXPLOSIONS IN 1879.

DURING 1879 the deaths from explosions in coal mines were considerably less than during the previous two years, the number having been 155, against 345 and 586 in 1877 and 1878. At the same time, comparatively small as was the number last year, from the evidence given before the coroners and fiscals, it is plain that almost every one of them was really preventable. At some of the collieries where the explosions took place lighted candles were taken into chambers filled with an explosive mixture; in others blasting was carried on where gas was known to be given off in considerable quantities; and in two or three instances the ventilation was neglected. Little attention appears to have been paid to those atmospherical changes which affect the gases in mines, whilst too great confidence was evidently placed in the barometer, which our ablest mining engineers say is not always to be relied upon, for explosions have taken place when the barometer has been rising. Fatalities from explosions can only be prevented by the strict enforcement of the general and special rules, the carrying out to the fullest extent of the Mines Regulation Act of 1872, the doing away with blasting in mines where gas is given off from the strata, the adoption of the best safety lamps, with a large and constant supply of fresh air sweeping through every working place. Where these precautions are not adopted—and they are certainly too often neglected—there will be explosions such as have taken place in different parts of the kingdom during the last year. It cannot be denied that legislation for the prevention of accidents in mines has been most successful in decreasing the death-rate. The Duplicate Shaft Act was passed in 1862, and three years preceding its coming into operation the deaths from colliery accidents throughout the kingdom were 3178, and during the same period 264,358,164 tons of coal were raised; whereas during the succeeding three years after the Act was passed there were raised 286,853,443 tons of coal, so that if the number of deaths had increased at the same rate as the coal raised had increased in quantity, the number of deaths during the triennial period would have been 3,348·4, whereas the actual number of deaths had been only 2748, being 600·4 fewer deaths during the second than in the first of the two consecutive triennial periods. There was thus a reduction in the fatalities in collieries in three years of 20·02 per cent., when considered in relation to the quantity of coal raised, or at the rate of 6·67 per cent. per annum. There is much, therefore, to be said in favour of the Duplicate Shaft Act, so far as regards the lessening of accidents of a fatal character in mines. More recent legislation, however, has turned out equally satisfactory, judging by results alone. The Mines Regulation Act was passed in 1872, and many of its provisions are certainly of a most stringent character, yet it has worked well. In the six years before it was passed the lives lost by explosions were 18·18 for each six million tons of coal raised, whilst for the six years following its operation and terminating with the close of 1879 the deaths from the same cause were only 12·97 for every six million tons of coal raised. The deaths from explosions and gas during 1879 were as follows:—

Jan.	12th	Dinas Colliery, South Wales	63
,,	25th	Hemsworth Colliery, near Pontefract ..	5
Feb.	11th	Garswood Hall, Lancashire	2
March	4th	Deep Drop Pit, Wakefield..	21
,,	22nd	Colliery in South Wales	1
,,	,,	Dewsbury Colliery	5
April	11th	Liversedge Colliery..	1
May	2nd	Swadlincote, near Burton	1
July	2nd	Blantyre Colliery, Scotland	28
,,	22nd	Drumpellier Colliery, Scotland	1
Sept.	12th	Lycett Colliery, North Stafford	8
,,	22nd	Warden Lloyd Colliery, South Wales ..	3
Oct.	21st	Cwm Dare Colliery, South Wales ..	3
Nov.	12th	Kelsall Colliery, Staffordshire	6
Dec.	2nd	Woodford Collery, Wigan	2
,,	23rd	Kearsley Colliery, near Bolton	5
			155

As to the preventability of most of these deaths there was ample evidence given. At the Dinas Colliery, the management was admitted to be very bad indeed. Some time before the explosion occurred, the manager, Mr. Chubb, who had previously been the overman, was summoned by Mr. Galloway, the then Sub-Inspector of Mines, for a breach of the Mines Act, when he was fined £10, and his certificate suspended for six months. The then overman, Griffiths, was appointed manager, and Chubb took his position of overman. Under such circumstances, an explosion was not to be wondered at. The disaster at Hemsworth was admitted to have resulted from blasting, which the owner voluntarily proposed to discontinue. At the colliery at Wakefield the management was virtually in the hands of two deputies, as the certificated manager seldom visited the colliery, but gave written instructions from the reports given in by the deputies. The death at Swadlincote was caused by insufficient ventilation, and the manager was summoned for neglect, and fined ten guineas and costs. The explosion at Blantyre was evidently the result of the greatest recklessness, for Mr. Dickinson, the Inspector of Mines, who conducted the inquiry, stated that they had found on the deceased lucifer matches, tobacco, and pipes, some of them appearing as if they had been recently smoked, whilst several of the lamps were unlocked. The firing of a shot at the Lycett Colliery ignited the gas and killed eight men. Candles appear to have been the cause of the explosion at the Woodford Colliery, whilst the same light also set fire to gas in some old workings at the Pelsall Colliery, killing six men, including the head engineer and a butty collier. At Kearsley also it appears that open lights were in use, instead of safety lamps. From the above statement it will be seen that there is the strongest ground for saying that nearly all the deaths from explosions last year were really preventible. As it may be of some interest to many to know whether explosions have been increasing or otherwise for some years hast, the following figures show the number of persons that pave been killed by explosions and the number of deaths for every million of tons of coal raised:—

Year.	No. of deaths.	Deaths per million tons.	Year.	No. of deaths.	Deaths per million tons.
1856 ..	236 ..	3·28	1870 ..	185 ..	1·63
1857 ..	377 ..	5·00	1871 ..	269 ..	2·29
1858 ..	215 ..	2·90	1872 ..	154 ..	1·24
1859 ..	95 ..	1·21	1873 ..	100 ..	0.77
1860 ..	863 ..	4·37	1874 ..	166 ..	1.31
1861 ..	119 ..	1·38	1875 ..	288 ..	2·16
1862 ..	190 ..	2·13	1876 ..	95 ..	0 70
1863 ..	163 ..	1·75	1877 ..	345 ..	2·57
1864 ..	94 ..	0·89	1878 ..	586 ..	4·45
1865 ..	168 ..	1·96	1879 ..	155 ..	1·01
1866 ..	651 ..	6.46			
1867 ..	286 ..	2·72		5,711	56·11
1868 ..	154 ..	1·47			
1869 ..	257 ..	2·37	Average .	211	2·25

THE COAL SUPPLY OF THE METROPOLIS.

WHILE London was half a century ago practically dependent for coal supply on one field alone, there is now not a field in Great Britain from which we do not draw in a greater or less degree. The total amount of coal imported by sea or brought by railway and canal into the London district during 1877 was 8,601,413 tons, of which 3,170,601 were seaborne, and 5,430,812 by rail. Of these totals, 9566 tons were cinders, 385 tons were culm, and 450 tons Australian boghead fuel. In 1878 the total imports were 8,804,335 tons, of which 3,198,309 were seaborne, and 5,606,026 by rail and canal, cinders figuring for 4252 tons, culm for 226, and Australian fuel for 567 tons. The seaborne supply for 1877 is thus divided:—From Newcastle, which heads the list, there came 1,657,013 tons, the produce of some fifty different collieries, sent in 1938 ships. Sunderland sent 889,401 tons from 26 collieries, in 1236 ships. Hartlepool and West Hartlepool sent 323,733 tons from 27 collieries, in 946 ships. Seaham sent 197,200 tons from 8 collieries, in 378 ships. Middlesborough 13,623 tons from 6 collieries, in 56 ships. Blyth, one consignment of 412. Yorkshire, 9901 tons from 20 collieries, in 147 ships. Duff, 4 shiploads, amounting to 3078 tons; 26,605 of small coal in 82 ships, from 13 different collieries. Scotland sent during the year 53,209 tons from 21 collieries, in 111 ships; and Wales, 19,089 tons from 13 collieries in 78 ships. In 1878 the figures were:—From Newcastle, 1,639,493 tons, in 2021 ships; from Sunderland, 843,245 tons, in 1207 ships; from Seaham, 197,822 tons, in 389 ships; from Hartlepool and West Hartlepool, 337,408 tons, in 988 ships; frem Middlesborough, 19,207 tons, in 62 ships; from Scotland, 48,126 tons, in 121 ships; from Wales, 19,142 tons, in 71 ships; from Yorkshire, 24,519 tons, in 247 ships; from Duff, two shiploads, of 723 tons, 30,525 tons of small, forming 158 cargoes; 9506 tons of cinders, forming 68 cargoes; two shiploads of culm, 38 tons; and two consignments of Australian boghead, 450 tons. The returns for the past year are of course incomplete, but they already indicate a total of well over nine millions of tons. A comparative statement of 1878 and 1879, from the 1st of January to the 30th of November in each year, gives for 1879 by railway 5,954,748 tons as compared with 5,073,808 in the previous year; or an increase in the present year, by railway, of 810,946 tons. By canal, 2729 tons came in the eleven months of the present year, against 2274 in the same period of 1878, or a decrease in the present year of 45 tons. This very large increase does not so much represent consumption as a falling off of depôts and stores, which had been allowed to run bare during the long period of depressed trade from which people are glad to believe we are just emerging. All the great lines north of the Thames contribute to the coal supply of the metropolis. The Midland stands first on the list as the great coal-carrier, followed at no great distance by the London and North-Western, then by the Great Northern, the Great Western, and the Great Eastern. Even the southern lines put in an appearance, the South-Western bringing in some Welsh coal and a little of the West of England coal, but their contributions do not much affect the great aggregate.

A return has been given of the proportion between the seaborne and the railway coal consumed in the metropolis, and the following statement for the month of November last, for which we are indebted to Mr. J. R. Scott, the Registrar of the Coal Market, will give a very good idea of the proportion in which the several lines contribute to the great aggregate. The Midland's quota for the month is 193,326, or at the rate of nearly 6500 tons per day, derived from 172 collieries. Over the London and North-Western Company's system came 137,083 tons, derived from over 260 collieries. Next in order stood the Great Northern, with 99,647 tons, from nearly 200 collieries, followed by the Great Western, with 85,251 tons, from 141 collieries; and by the Great Eastern with 74,681 tons, from 183 collieries. On this monthly statement, the London and South-Western figures for 10,746 tons of Welsh, and 1029 tons of "sundries;" the London and Chatham, for 1615 tons of locomotive coke, and 30 tons of sundries; and the South-Eastern, for 1107 tons of locomotive coke, and 368 tons of Welsh, and 97 tons of steam coal; while the canal quota was 272 tons. This return includes a total quantity of railway borne coal, passing in transition through the district of 105,780 tons. To obtain an approximation, therefore, to the quantity consumed within the coal duty limits, this amount must deducted, giving a total for metropolitan consumption of 499,021 tons. The different systems of railway so overlap and compete with each other that it would be a difficult task to exactly define the limits of each; but, speaking broadly, the Midland serves the Derbyshire and Midland counties coal-producing district; the London and North-Western the Lancashire district, with parts of Leicestershire and Staffordshire, and Cheshire; the Great Northern South Yorkshire and Nottinghamshire, the Great Eastern competing over part of the same area; while the Great Western has the Forest of Dean, and the Bristol deposits, and South Wales. As a rule, the railway rates are on a mileage basis; and this rule, which is perhaps more generally followed on the Midland system than on any other, does not obtain where there is much competition, the effect of which is to place the more distant collieries pretty much on a par in regard to the cost of transport with those nearest to London. If all were averaged the result would probably give a mean rate of about a farthing per ton per mile for all the coal brought by railways into the metropolis.

Northern Lead Mining in 1879.—The greatest contributor to the output of lead in Britain is the district which embraces the two northern counties of Northumberland and Durham, which includes some of the oldest and most prolific lead mines. But in common with most of the lead-producing districts there has been known in the north a dulness which during the early part of the year 1879 was intensified, causing prices to descend to an unprofitable pitch, and consequently reducing the output in many of the districts. During a large part of the year the largest set of mines—the Weardale mines—were entirely closed, and, as they were the largest yielding mines, the output of lead must have been in the two northern counties very largely restricted, and must have fallen considerably from the 16,869 tons of lead ore which were produced in 1878. But as the price of pig lead had fallen from £4 to £5 per ton in 1878—the year ending with common English pig lead at £14 12s. 6d.—this was not to be wondered at. There was, however, in the early months of 1879 a further fall in the price, and it fell to £13 5s., but from March the tendency has been first firmer, and latterly a very considerable advance has been known in the price, and £18 per ton may be taken as the rate at the close of the year. Hence there has been a very marked change in the condition of the lead mining districts, and that change is seen in the great district of the north of England. For the first six months of the year the production in Allendale, Weardale, and Teesdale was very much reduced, and the number of lead miners employed was materially lessened, while the wages paid—or the rate at which the contracts were let—were also reduced. But in the latter months of the year the stocks of pig-lead that had accumulated at the smelting works have been reduced, and the employment afforded to the miners has been increased, while there has been a re-opening of several mines, including some of the noted "W.B." mines of the Beaumont family, in Weardale. As yet the benefit of the workmen is chiefly in fuller employment, for the rate of wages has known no material change; but it is probable, if the price of lead continues to increase, that there will be a change in this respect also. The rise in the value of lead in the market is changing the condition of the lead industries, and developing in many of the centres the production; and though in the north of England there is a not inconsiderable competition caused by the importation of foreign lead, yet the production of lead ore in the dales of Durham is considerably in excess of that which might have been supposed probable a few months ago. The falling off during the present year has been chiefly in the Durham district, but the recovery there is only partial, at least so far as Weardale is concerned, from which there is the largest output. In Teesdale the production has been less affected, but this is because some of the landowners have made concessions during the depression to the lead-mining companies in the shape of slight reductions of the royalties, and thus the mines have continued at work, lead being stocked during the period of lowest prices until the change has come. One of the most marked features of the year is seen in the tendency on the part of the great companies to minimise the expenses by concentrating the output; and there has been a movement in the same direction by the introduction in several instances of newer machinery for the washing of lead ore. The lessening of the cost of production has also been attempted in other directions; and the recent increase in the market prices of lead has materially improved the position of the lead mining companies, while the possibility of further increase in prices would add to their benefit, for the cost of production does not increase so rapidly as it does with cognate industries. Lead-mining is usually carried on in isolated districts, and under conditions which do not allow of such a pressure in the labour market as is often felt in the coal and iron trades; and hence labour fluctuations are not so frequent in the former as in the latter industries. Thus, in the north of England, the cost of production having been minimised, it is certain that for some time to come there will be no rapid increase, while the increase in prices, accomplished and expectant, must place lead-mining in a very different position in the future to what it has been in the recent past.—*Times.*

SANITARY ENGINEERING, GAS AND WATER.

THE SEWERAGE WORKS FOR THE CROYDON RURAL SANITARY AUTHORITY.[*]

By W. Santo Crimp, A.M.I.C.E., F.G.S.

THE sewerage works at the present time under course of construction for the Croydon Rural Sanitary Authority involves the construction of over 36 miles of brick, brick and concrete, and pipe sewers; the erection of a pumping station, with the necessary machinery for pumping the low level sewage, and for the subsequent treatment of the sludge; the preparation of an intermittent filtration area for the purification of the sewage; the construction of an iron bridge over the river Wandle; the boring of an artesian well, and the erection of two detached cottages; in connection with the sewerage and disposal of the sewage of the parishes of Beddington, Merton, Mitcham, and Morden, and the hamlet of Wallington, Surrey, containing a rapidly increasing population, estimated at the present time at about 17,000. The system adopted throughout for the drainage of these districts is the water-carriage system, with which all engineers are familiar. The rainfall is not admitted into the new sewers, but is conveyed directly to the natural watercourses, by the sewers existing previous to the construction of the new system, which are in every case retained for this purpose. Nearly the whole of the sewage will flow directly on to the filtration area by gravitation alone, a portion only of the districts of Merton and Morden, containing about 300 houses, requiring the services of a low level outfall, from whence the sewage is subsequently pumped at the sewage works from a depth of 20 feet into the gravitation outfall.

The sewers are of four types. No. 1 is the stoneware, salt-glazed, socket drain pipe as manufactured by Doulton and Co., and which requires no further description. The mode of jointing these sewers is as follows:—Tarred gasket is first forced into the joint, which has the effect of preserving the concentricity of the pipes, and the prevention of the entry of any sand into the sewers; the annular space is then filled with neat Portland cement, and a fillet of the same worked around the outside. Care is taken that no cement shall form a projection on the inside of the sewer, each joint being carefully cleaned as the work proceeds. In very wet ground the water in the trench is pumped down from a sumph in advance of the sewer, until the cement joints are made, when a layer of puddled clay is placed around the newly made joint, which serves the double purpose of keeping the cement in place until set and of stopping any possible leak that may occur through the accidental fracture of a joint on the subsequent refilling of the trench. The pipes previous to being laid in the trenches are fitted together on the surface in convenient lengths, so that the invert may be perfectly true, and the space between the socket and spigot such that a sufficient quantity of cement may be admitted all round to ensure a watertight joint. All pipes have more than a slight deviation from the true circular are rejected, it being impossible to meet the above requirements with ill-shaped pipes. The pipes are each tested by being struck with a small hammer, by means of which the presence of a flaw is readily detected. No. 2 is a combination of the stoneware pipes as before described, embedded in Portland cement concrete. This method of construction is adopted for sewers up to 18 inches in diameter, when laid in deep cuttings in treacherous ground. No. 3 section of sewer is in the type which has been adopted for the main gravitation outfall. This sewer is constructed of an inner ring of brickwork, surrounded by a Portland cement collar joint one inch in thickness, the whole embedded in Portland cement concrete. The collar joint has been introduced for the purpose of keeping the sewer watertight, and has been found most efficient. The method of constructing these sewers is as follows: 6 inches of concrete having been placed on the bottom of the trench, a semicircular mould like an inverted centre is placed thereon; the concrete is then well worked in up to the springing, and the moulds are not removed until the concrete is thoroughly set; on the removal of the moulds the collar joint and brickwork is proceeded with, and the remainder of the concrete in due course. No. 4 section of sewer has been adopted for the tank sewer, for the reception of the low level sewage during the time the pumping engines are at rest. It is constructed of two rings of brickwork with cement collar joint as before described between the inner and outer ring. The importance of constructing the whole of the sewers as nearly as possible watertight, apart from sanitary reasons, will be apparent when the capacity of the main outfall is considered, the theoretical maximum discharge from the sewer, when not working under pressure, being 501 cubic feet per minute, and no less than 33 miles of the new system of sewers contribute to the same. The total number of joints in this length of sewer will be about 90,000, and the effect of the leakage of one drop of water per second at each joint would be to bring a volume of water on to the filtration area equal to an annual rainfall of 62 inches.

Manholes, circular in form, 5 feet internal diameter at the bottom, and 2 feet at the top, are constructed at all intersections of streets, and at each junction of a branch with a main sewer; also a manhole or combined ventilator and lamphole is placed at each change of direction or gradient of the sewers, the straight line principle being adhered to with few exceptions throughout. Any part of the system may be thus readily examined, and the locality of any defect or obstruction be at once detected. The outlet from each manhole is provided with a stoneware flushing block, having a ground face, and two projecting iron clips for the reception of a wooden stop-board as an arrangement for flushing. The inlets are each provided with a stoneware balance valve having an iron flap hung at the top, and in the centre of the flap a screwed spindle with ball at end, by means of which the amount of opening at the bottom can be easily arranged. The object to be obtained by the use of these valves is to prevent the passage of currents of air through the sewers, and to localise and expel the gases generated in each division. These manholes and ventilators are finished at top with a Latham's patent spiral charcoal ventilator, a full description of which may be found in "Sanitary Engineering," by Baldwin Latham, and also in the illustrated catalogues of the principal manufacturers of fittings for drainage works. The author does not propose to discuss in this paper the question of the effect of charcoal or the gases which are eliminated from sewage, there being many standard works of reference on this subject. The minimum fall for the various sizes of sewers is as follows:—

27 inch..	1 in 1200
24 „	1 „ 900
18 „	1 „ 900
15 „	1 „ 700
12 „	1 „ 560
9 „	1 „ 300

and the whole of the sewers will be self-cleansing, as the minimum velocity in any sewer when running half full will be 118 feet per minute. Flushing wells are constructed at various points on the system, the points selected being such that a sufficient supply of subsoil water may be obtained for flushing purposes, and as large a district as possible be under the influence of the well. These flushing wells are constructed in a similar manner to the manholes, with the exception of the bottom works being laid dry to allow of the accumulation of the subsoil water in the well. They are connected to a manhole on the sewers by a line of pipes provided with a sluice valve, on opening which the flushing of the sewers is easily and readily effected. The pipe sewers at all crossings under railways or rivers are constructed of cast iron, and the brick and concrete sewers are strengthened by an additional ring of brickwork. The cement used on the works is the best Portland. No cement is used that is incapable of bearing a tensile strain of 350 lb. to the square inch when tested on a section having an area of $2\frac{1}{4}$ square inches, after seven days' immersion in water. An Adie's cement testing machine is used for testing the bricquettes. The proportions for the concrete are six measures of clean gravel and sand to one measure of Portland cement; and the cement mortar, two of clean sand to one of Portland cement.

The pumping machinery, manufactured by Hathorn, Davey and Co., of Leeds, comprises a pair of horizontal, rotative pumping engines. Each engine and pump is capable of lifting 7500 cubic feet of sewage 20 feet high per hour, when working at not more than thirty revolutions per minute, in addition to driving the gearing for one chemical mixer and one pump for the filter presses, the use of which will be described hereafter. The steam cylinders are 12 inches in diameter, stroke 20 inches, fitted with slide and expansion valves. An air pump and a condenser, self-contained in one casting, are provided for each engine, worked from the end of the engine piston rod. The boilers are of the Cornish type, diameter 5 feet 3 inches, length 14 feet; flues, 2 feet 9 inches diameter. The fly-wheels each weigh 1 ton. The main pipes are similar to those designed by Mr. Baldwin Latham for the Dantzic Sewerage Works; each pump having a piston and plunger $22\frac{1}{4}$ inches and 16 inches in diameter, with a stroke of 20 inches, the pumps being worked directly from a disc on the end of the crankshaft.

There are two filter presses for the treatment of the sludge, one of Needham and Kite's, and one of Johnson's. The sewage from the high and low level sewers will be received into the tanks within the pumping station, and after being filtered through coke, will be conveyed, by means of properly constructed main and subsidiary carriers, into the filtration area; the deposited sludge being subsequently treated by chemicals and by the filter presses.

The intermittent filtration area for the final reception and purification of the sewage consists of an area of land 28 acres in extent. The character of this land varies considerably, being composed of alluvial deposit overlaying the London clay, the constituents of the deposits being beds of gravel and sand, marsh, clay, and peat. The depth from the surface of the ground to the London clay varies from 3 to 17 feet. Subsoil drains for the reception of the purified effluent will be laid at the requisite levels. The impervious beds where necessary will be burnt into ballast or removed, and suitable porous material substituted down to the level of the subsoil drains. The purified effluent will eventually flow into the river Wandle. The whole filtration area is inclosed by a clay puddle wall 2 feet in thickness, the excavation for which has been taken down and 1 foot into the London clay. It has the effect of effectually preventing the passage of any water either from the river Wandle or the surrounding waterlogged strata into the filtration area. An artesian well has been sunk at the pumping station for supplying the water required for the condensers and for other purposes. This well is 6 inches in diameter, lined with cast-iron pipes, fitted with wrought-iron flush collars, the bottom pipe being provided with a steel shoe. The well is bored to a total depth of 230 feet through the following strata:—

Alluvium	12 feet.
London clay	80 „
Woolwich and Reading beds ..	40 „
Thanet sand	47 „
Into the chalk..	51 „

Depth to chalk 179 feet, the bottom 30 feet of which is not lined. The volume of water flowing from the well, and which is derived from the chalk, has remained constant since the completion of the boring. The yield is at the rate of 5·79 cubic feet per minute, or 52,100 gallons per 24 hours, and the temperature of the water 54°.

These works were designed and are being carried out by Mr. Baldwin Latham, M.I.C.E., as engineer-in-chief, the author acting as resident engineer. The total amount of the contract for the whole of the specified works is £74,708, the contractors being Messrs. B. Cooke and Co., of Phœnix Wharf, Battersea.

"THE RIVER THAMES."[*]

By John Baldry Redman, M. Inst. C.E.

A COMPARISON of the tides, registered at Sheerness and the old or upper Shadwell entrance of the London Docks, shows a continuous increase in range in the Port of London, and is so remarkable to deserve special record. This growing tidal action is illustrated by the increased differences between the high waters and low waters at the two stations. The maximum high-water difference hitherto recorded was 6 feet 4 inches on the 27th of February, 1874; but on the 17th of April, 1877, a difference of 6 feet 11 inches occurred, due to a gale from E. to E.N.E. on that and the preceding days. Many tides of that year gave an excess of elevation amounting to more than 5 feet in London; several also in 1878. The low-water differences are quite as remarkable, showing how pronounced and accentuated is now the metropolitan tidal action. On the 14th of November, 1840, with a W.S.W. gale, low water in London was 3 feet 11 inches lower than at Sheerness. On the 24th of December, 1877, with a west gale, the low water was 4 feet 4 inches lower than at Sheerness, and other tides with westerly gales at the end of this year gave lower low water in London by 2 feet to 3 feet 5 inches. On the 27th of January, 1877, a difference of 3 feet 9 inches occurred with a neap tide and W.N.W. gale; and with westerly gales many tides during this year were at low water 2 feet 2 inches to 3 feet 5 inches lower in London. In November and December, 1878, with neap tides and W.N.W. winds, there were differences of from 2 feet 10 inches to 3 feet 4 inches in favour of London. The greatest low-water difference in favour of Sheerness, *i.e.* lower, was on the 2nd of March, 1877, being 2 feet 1 inch, and in August, 1873, and in February, 1874, amounting to 2 feet 5 inches In proof of the increased tidal range in the metropolis on the 21st of January, 1878, the tide ebbed down to 23 feet 2 inches below Trinity high water, with a S.W. gale, or lower than was ever before recorded. But the number of ebbs below 20 feet under Trinity high water have marvellously increased, as will be seen by the annexed table, due no doubt in a great measure to the removal of shoals in the lower reaches of the river. The low ebbs are usually accompanied by westerly gales. The result is, that the mean high water of the year is now within 9 inches or 10 inches of Trinity high water. High water of an ordinary spring tide is now 10 inches or 12 inches higher, an equinoctial spring tide 2 feet higher, and abnormal tides, due to northerly gales during the equinoxes with heavy land floods, have attained to 4 feet and 4 feet 6 inches above that datum, or 9 inches in excess of any previously recorded. The wind frequently also accompanies the tide around the British Isles, making the circuit with the ocean current, a S.W. wind blowing up the English and Irish Channels, and a north wind down the North Sea. This may often be seen by reference to the daily weather charts of the Meteorological Committee. The heights calculated by the Admiralty authorities and the actual range of the tides closely approximate, except when affected by wind, and differences of 3 feet to 3 feet 3 inches will occur at times in excess with N.W. winds. The tide is sometimes checked, and loses from 1 foot 3 inches to 3 feet 2 inches of its computed range with westerly gales. From these causes differences in range of two successive tides occur, amounting to from 3 feet to 7 feet. Spring tides, from their greater volume, when differing from the Admiralty forecast, are usually in excess from the effect of gales of wind, the greatest influence being exercised by those from N. to N.W. Neap tides, from their reduced volume, feel less such disturbing causes, and are as often short of the estimated height as above it. The mean low water of the entire year is now 1 inch lower than any analysis shows for forty-five years, and the high water of the entire year is now nearly 3 inches higher than any year prior to 1875. The average increased elevation of high water in London as compared with Sheerness is now higher by from 4 inches to 5 inches than the average difference from 1833 to 1845. The effect of wind at times appears anomalous; but an examination of the daily weather charts of the Meteorological Committee shows plainly enough the causes of variation.

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[*] Read at the Mitcham Meeting of the Association of Municipal and Sanitary Engineers and Surveyors.

[*] Read before the Institution of Civil Engineers.

THAMES TIDES.

Abstract of Extreme Ebbs exceeding 20 Feet below the Trinity Standard.

Sheerness.

Year.	Total Number of Ebbs exceeding 20 feet below Trinity Standard, and Dates of Lowest.	Below Trinity Standard +20 feet.		Trinity Standard 11 ft. 3 ins. above zero. Below zero of Tide Gauge +8 ft. 9 ins.	
		feet.	in.	feet	in.
1833	122, Oct. 14th, a.m. ..	22	1	10	10
1834	112, Feb. 26th, a.m. ..	22	6	11	3
1835	*78, Feb. 17th and 18th, a.m.,; April 14th a.m...	21	8	10	5
1836	*94, Jan. 23rd, a.m. ..	22	6	11	3
1837	*79, Feb. 7th, a.m. ..	22	5	11	2
1838	97, Mar. 27th, a.m. ..	22	2	10	11
1839	81, Feb. 16th, a.m. ..	22	2	10	11
1840	71, Feb. 10th, a.m. ..	21	1	9	10
1841	51, Dec. 15th, p.m. ..	21	3	10	0
1842	*34, Feb. 10th, p.m. ..	22	10	11	7
1843	*35, Mar. 17th, a.m. ..	22	9	11	6
1873	85, Sept. 9th, a.m. ..	20	9	9	6
1874	118, Mar. 21st, a.m. ..	21	9	10	6
1875	62, Feb. and June ..	20	6	9	3
1876	66, April 25th, p.m. ..	21	0	9	9
1877	†95, Mar. 2nd, a.m. ..	22	9	11	6
1878	78, Jan. 21st, a.m.; Sept. 15th, p.m.	22 22	7 8	11 11	4 5

London Docks.

Year.	Total Number of Ebbs +20 feet below Trinity Stanard, and Dates of Lowest.	Trinity Standard on Tide Gauge 25 ft. 4 ins. Below Trinity Standard.		Above zero of Tide Gauge.	
		feet.	in.	feet.	in.
1833	8, Aug. 31st, a.m. ..	21	4	4	0
1834	21, Feb. 26th, a.m.; Mar. 1st, p.m.; Nov. 5th, a.m.	21	1	4	3
1835	12, Feb. 23rd, p.m. ..	20	10	4	6
1836	17, Jan. 23rd, p.m. ..	21	7	3	9
1837	27, Jan. 9th, a.m. ..	21	1	4	3
1838	26, Oct. 19th, a.m. ..	20	10	4	6
1839	24, Mar. 15th, a.m. ..	22	2	3	2
1840	26, Aug. 18th, p.m. ..	21	4	4	0
1841	24, Jan. 10th, p.m.; Oct. 18th, a.m.	21	4	4	0
1842	25, Jan. 27th, a.m. ..	21	8	3	8
1843	34, Oct. 28th, p.m. ..	22	5	2	11
1873	69, April 28th, a.m. ..	20	11	4	5
1874	85, Aug. 31st, a.m. ..	21	9	3	7
1875	58, Mar. 22nd, ..	20	10	4	6
1876	46, Feb. 13th, a.m. ..	21	4	4	0
1877	43, Dec. 24th, p.m. ..	22	0	3	4
1878	53, Jan. 21st, a.m. ..	23	2	2	2

* Ebbs effected (reduced in number) by gathering of mud grounding float. Day tides alone registered at the London Docks.

† In this year the month of June alone was registered for the two first days, the tide gauge being under repair, so that No. 95 is for eleven months only. N.B.—Applies to Sheerness only.

N.B.—These tables show that from 1833 to 1839 there was a very small proportion of ebbs below 20 feet under Trinity in the Port of London as compared with those at sea. But from 1840 to 1843 inclusive this proportion considerably increased. This increase is still more manifest from 1873 to 1878 inclusive. In fact, the proportion is now reversed, *i.e.*, whereas formerly there were a much fewer number of low ebbs in London as compared with those at sea, now there are a much greater number, showing how much the low water is lowered in London, and how much lower at times it is than at sea.

RAILWAYS & TRAMWAYS.

RAILWAYS IN 1879.

NONE of our great national industries has greater claim to review at the close of a year than has the working of the great railway system, for it is not only a large employer of labour, but its wants form no small portion of the demand that several important industries exist to meet. And the effect of dulness in some of these, whilst reflecting on the traffic receipts of the great railway companies, is to some extent caused by the effects of depression in the latter, as the results of the experience of the year 1879 prove. Through the great bulk of the year there has been a declension, more or less marked, in the receipts of the great railway companies; and in consequence a general retrenchment has been necessary, in spite of which dividends have materially fallen. Only during the last quarter of the year has there been much recovery generally; but that recovery has been more than a nominal one. There has not only been an increase in the gross receipts on traffic account, but that increase has been real—it has been an increased return per mile on the mileage worked, when compared with the receipts per mile for the corresponding period of last year. There has been, moreover, retrenchment in another direction—the capital expenditure has been reduced, and the completion of many of the large works of construction that have been years in progress has relieved the system of a drain, and has tapped fresh streams of traffic.

The first and most striking feature of the results of the working of the chief railways is the large falling off in the traffic receipts. It is true that on some railways having mineral and goods traffic preponderating this has been much larger than on others where the passenger traffic preponderates; but it has been very general. In the first half of the year the chief companies marked the following results as the financial return for the half-year:—

London and North-Western ..	£151,000 decrease.
North-Eastern	307,600 ,,
Midland	32,200 increase.
Great Northern	66,000 ,,
Lancashire and Yorkshire ..	91,000 decrease.

These are the gross increases or decreases when the receipts for the first half of the year 1879 are compared with those for the correspondent preceding half-year. And though, through the opening of new lines or other special causes, two of the representative railways above named show declensions, the fact that the three great systems which tap the great manufacturing districts of the country showed a decrease of over £90,000 a month is an indication of the intensity of the depression during the first half of the year, although the immense reductions that were made in the working expenses prevented the full effect of that decrease being felt in the dividends declared for the half-year.

As we have indicated, there has been a very considerable recovery in the second half of the year in the traffic receipts of the chief companies. It is true that there are no very great enlargements of receipts to record, for the declension continued during the first part of the half-year, but a general improvement has been witnessed during the latter part, which has materially reduced the amount of the decreases, and in one or two instances has swept them away, and it is certain that in every case the decrease for the second half of the year will be less than that for the first half. It may be roughly said, indeed, that there is now established a revival in the railway receipts, and that the weekly returns will, for some time to come, show increases instead of decreases, though, in certain exceptional instances there are occasional decreases, but even in these their ratio is much less than it was a few months ago. The traffic returns of the companies that have been named may be said to show, on an approximate estimate, receipts for the last half of 1879 increased or decreaied over or under those for the corresponding half of 1878 by the following amounts:—

London and North-Western ..	£30,000 decrease.
North-Eastern	170,000 ,,
Midland	10,000 increase.
Great Northern	5,000 ,,
Lancashire and Yorkshire ..	50,000 decrease.

In the worst instances it is evident that the ratio of the decrease has been reduced, and in others the change has been so marked that the decreaee in the first part of the year is converted into an increase, though not to any very large amount in any case. But two other influences will affect the dividends for the second half of 1879. In the first place, very great economy has continued to be practised upon the railways during the latter half of the year, and in some instances these economies are larger in the second half than in the first. Coal has continued equally cheap, and where the traffic is largely reduced the consumption has been less, whilst the price of most other articles of railway consumption has been at a minimum. Hence the working expenses may be expected to have fallen fully in a ratio with the gross receipts, and thus there will be very substantial reductions to set against the lessened receipts. But, on the other hand, the capital on which dividend has had to be paid is larger; very considerable sums have been spent, and are being spent, on new works, and the additional capital thus called into existence will claim its share of the dividend, although in not a few instances it has been raised by debenture stock at a low rate of interest. On several of these important railway systems there were very large works in course of construction when the trading depression set in, but they are now completed or near completion, and in the future the benefit will be reaped in the return from these works as they become productive, and in the reduction of the capital expenditure.

For 1879 it is probable that the general return of dividends on railway capital will be the lowest for a considerable period. Not only is there the probability of a fuller trade, but that trade is more valuable. In most of the chief industries the tendency is towards an increased price and to an increased cost of production. The rate of wages, which has for so long tended downwards, is now beginning to rise, and with every increase the purchase power of the people is enlarged, and railway traffic feels speedily the change. There are districts where the prosperity or adversity of our railways is indicated in very considerable degree by the number of the blast furnaces, mines, or factories at work. Not that the mineral or goods traffic preponderate so greatly, but because other industries are affected by the great controlling ones of the district, and with expanding trade there are speedily larger passenger receipts. The reports from the great centres of manufacture leave no doubt that a general revival of trade is now fairly begun, and with that trade revival there will be a large increase in railway traffics and an addition to the dividends. And not only will this be from the old sources, but new streams of traffic have been opened out at very great cost which should now become springs to add materially to the volume that flows over the lines of the companies that created them. Altogether, unless there should be some change which cannot be foreseen, the prospects before our great railways are much more favourable than those during the years of gloom that have been waded through.—*Standard*.

The Railway Commission.—In consequence of the recent decision in the Queen's Bench in favour of the appeal of the South-Eastern Railway Company against the Railway Commissioners and the Hastings Corporation, the Jarrow Corporation have withdrawn an analogous case against the North-Eastern Company, but resolved to petition Parliament to appoint a Commission with power to protect the public against railway monopolies.

The Severn Tunnel Works.—One of the three powerful pumps, each of which is capable of raising 150,000 gallons per hour, employed in endeavouring to free the Severn Tunnel works from water, has broken down, and it is believed that the contractor will have to resort to the original intention of sinking an air-shaft, as the divers have met with little success in their search for the seat of the mischief. Since the pumping commenced the water has been reduced 20 feet to 30 feet, but there still remain 150 feet in the shaft.

The Forth Bridge.—A meeting of the directors of the Forth Bridge Railway Company was held on Monday last in the offices of the North British Railway Company, at which, the *Scotsman* believes, the contracts for the construction of the bridge, which have now been finaly adjusted, were signed. Later accounts state that the promoters of the scheme intend applying to the Board of Trade for power to lower the height of the proposed bridge from 150 feet to 135 feet or 140 feet, in view of the Tay Bridge disaster. This will necessitate, if granted, the lowering of the topgallant masts of large vessels passing underneath the bridge. A tender for second-class steel for the girders of the bridge has been secured by Herr Krupp's firm.

New Road Locomotive.—A compressed-air engine, intended, among other things, to supersede animal power on tramways, has just undergone a preliminary trial with much success at Leeds. The new engine is the invention of Colonel Beaumont, M.P., and among the parties who witnessed the recent experiment were some of the directors and chief officials of the Great Northern Railway Company, together with Captain English, R.E., of the War Office. It is expected that a locomotive constructed on this principle will shortly be tried at the Royal Arsenal, Woolwich, where it is likely to be of peculiar value in drawing the gunpowder-waggons along the line of railway to the magazines in the Plumstead Marshes. The invention has already received the attention and approval of several of the leading scientific men of the day. It is calculated that the engine tried at Leeds would be able to draw a loaded tramcar ten miles without taking in a fresh supply of compressed air. When the latter process becomes necessary, it can be accomplished as readily as an ordinary engine can take in its supply of water for creating steam.

The Proposed Reconstruction of the Tay Bridge.—At a special meeting of the Dundee Harbour Trustees on Monday, the Chairman (Provost Brownlow) explained that he had called the meeting because there was a proposal on the part of the North British Railway Company to ask Parliament to suspend the standing orders to enable them to introduce a Bill this session for the reconstruction of the bridge, and he wished an expression from the members of the board which might be useful to the railway company, and strengthen their hands while considering the question of reconstructing the bridge. Plans of the proposed reconstruction had been drawn, and so far as he could make out from a description of them given by Mr. Waddell, contractor, the North British Railway Company proposed to build the fallen piers o brick up to the height of the underside of the girders which were standing on each side; the spans were to be bow-strung girders, and that all the piers were to be stayed by malleable iron stays fixed to malleable iron piles on either side of the bridge. After some conversation, the following motion was unanimously passed:—"That the Harbour Trustees desire to record their sense of the great and dreadful calamity which occurred on the evening of Sunday, 28th ult., by the fall of the centre portion of the Tay Bridge, along with a passenger-train, which was passing over it, and to express their deep sympathy with the relatives and friends of the sufferers. That regarding the Tay Bridge as forming an essential part of the great route of railway communication by the east coast between England and Scotland, and as of the utmost importance to the town and trade of Dundee, especially as regards the facilities thereby afforded for the transmission of traffic to and from the harbour, this meeting would express its earnest hope that the directors of the North British Railway Company will, without delay, proceed to take steps for the reconstruction of the bridge, with a double line of rails; and the Harbour Trustees would be prepared to consider favourably a plan for its reconstruction at a considerably lower level than the present." It was agreed to vote £100 to the Relief Fund.